GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE
(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN ELECTRONICS & COMMUNICATION ENGINEERING
(ACCREDITATED BY NBA)

COURSE STRUCTURE AND SYLLABI
UNDER RG 22 REGULATIONS

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GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE

AUTONOMOUS

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

(ACCREDITATED BY NBA)

DEPARTMENT VISION

Achieving academic excellence in Electronics and Communication Engineering by shaping next-generation technocrats keeping pace with socio-economic needs.

DEPARTMENT MISSION

M1: Adopting outcome oriented teaching -learning processes to provide comprehensive knowledge in the application of Electronics and Communication Engineering principles.

M2: Striving for implementation of advanced technology to cater to industrial demands and societal concerns.

M3: Producing highly skilled and responsible professionals with robust ethical values.

M4: Integrating technical capabilities, life skills and entrepreneurship abilities to produce dynamic contributors to social advancement.

Program Educational Objectives (PEOs)

PEO-1: Demonstrating a deep passion for continuous learning through technical expertise for a promising career.

PEO-2: Exhibiting a strong commitment to serving the society with adherence to professional ethics.

PEO-3: Managing resources efficiently as competent engineers through effective social interaction.

PEO-4: Engaging in advanced learning and contributing to technological innovations.

Program Outcomes

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**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.
PO4	**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.
PO5	**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.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**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
PO8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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.

Program Specific Outcomes

PSO1 Design and develop electronic circuits and communication systems, applying the principles of signal, image processing, VLSI, Embedded and wireless applications relevant to industry and society.

PSO2 Adopting software tools like Matlab, Xilinx, Microwind, NS-2 to develop intelligent systems to offer customized solutions.

Semester-3 (Theory-7,Lab-3,MC-1)							
Sl. No.	Category	Course Code	CourseTitle	Hoursperweek			Credits
				L	T	P	C
1	BSC	22A0015T	ComplexVariables&Numerical Methods	3	0	0	3
2	BSC	22A0020T	ProbabilityTheoryandStochasticProcesses	3	0	0	3
3	PCC	22A0404T	SignalsandSystems	3	0	0	3
4	PCC	22A0405T	DigitalLogicDesign	3	0	0	3
5	HSC	22A0021T	UniversalHumanValues	3	0	0	3
6	PCC	22A0406T	AnalogCircuits	3	0	0	3
7	PCC(Lab)	22A0407P	SimulationLab	0	0	3	1.5
8	PCC(Lab)	22A0408P	DigitalLogic DesignLab	0	0	3	1.5
9	PCC(Lab)	22A0409P	AnalogCircuitsLab	0	0	3	1.5
10	SC	22A3205	**SkillOrientedCourse:** PythonProgramming	1	0	2	2
11	MC	22A0029M	**MandatoryCourse:** ConstitutionofIndia	2	0	0	0
			Totalcredits				**24.5**

Category	Credits
BasicScienceCourse(BSC)	6
ProfessionalCoreCourses(PCC)	13.5
HumanitiesandSocialScienceCourse(HSC)	3
SkillOrientedCourse (SC)	2
Total	24.5

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Semester-4(Theory-6,Lab-3,MC-1)							
Sl. No	Category	Course Code	CourseTitle	Hoursperweek			Credits
				L	T	P	C
1	HSC	22A0022T	ManagerialEconomics &FinancialAnalysis	3	0	0	3
2	ESC	22A0205T	ElectricalEngineering	3	0	0	3
3	PCC	22A0414T	ElectromagneticWavesand TransmissionLines	3	0	0	3
4	PCC	22A0415T	Analog&DigitalCommunications	3	0	0	3
5	PCC	22A0416T	LinearICApplications	3	0	0	3
6	PCC(Lab)	22A0417T	Linear ICApplicationsLab	0	0	3	1.5
7	ESC(Lab)	22A0206P	ElectricalEngineering Lab	0	0	3	1.5
8	PCC(Lab)	22A0418P	Analog&DigitalCommunicationsLab	0	0	3	1.5
9	SC	22A0419P	**SkillOrientedCourse:** PCB&CircuitDesigning	1	0	2	2
10	MC	22A0027M	**MandatoryCourse:** EnvironmentalStudies	2	0	0	0
						Totalcredits	**21.5**
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

Category	Credits
HumanitiesandSocialScienceCourse(HSC)	3
EngineeringScienceCourse(ESC)	4.5
ProfessionalCoreCourses(PCC)	12
SkillorientedCourse(SC)	2
Total	21.5

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Semester-5(Theory-6,Lab-2,MC-1)							
Sl. No.	Category	Course Code	CourseTitle	Hoursperweek			Credits
				L	T	P	C
1	PCC	22A0420T	DigitalSystemDesignthroughVerilog	3	0	0	3
2	PCC	22A0213T	ControlSystems	3	0	0	3
3	PCC	22A0421T	Antennas&MicrowaveEngineering	3	0	0	3
4	PEC		**ProfessionalElective-I**	3	0	0	3
5	OEC		**OpenElective-I**	3	0	0	3
6	PCC(Lab)	22A0425P	DigitalSystemDesignthroughVerilogLab	0	0	3	1.5
7	PCC(Lab)	22A0426P	Antennas&MicrowaveEngineering Lab	0	0	3	1.5
8	SC	22A0028P	**SkillAdvancedCourse:** SoftSkills	1	0	2	2
9	MC	22A0526	**MandatoryCourse:** DesignThinkingandInnovation	2	0	0	0
10	CSP	22A0459	Evaluation of Community Service Project	0	0	0	1.5
						Totalcredits	**21.5**

S.No.	CourseCode	NameoftheProfessionalElective-I
1	22A0422T	DataCommunication&Networks
2	22A0423T	InformationTheoryandCoding
3	22A0424T	IndustrialElectronics

S.No.	CourseCode	NameoftheOpenElective-I
1	22A0512T	DatabaseManagementSystems
2	22A0214Ta	PowerElectronics
3	22A0332Tc	FundamentalsofDrone Technology
4	22A0149T	BuildingMaterials

Category	Credits
ProfessionalCoreCourses(PCC)	12
ProfessionalElectiveCourses(PEC)	3
OpenElectiveCourses (OEC)	3
SkillAdvancedCourse(SC)	2
SummerInternship	1.5
Total	21.5

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Semester-6(Theory-7,Lab-3,MC-1)							
Sl. No.	Category	Course Code	CourseTitle	Hoursperweek			Credits
				L	T	P	C
1	PCC	22A0434T	MicroprocessorandMicrocontroller	3	0	0	3
2	PCC	22A0435T	DigitalSignalProcessing	3	0	0	3
3	PCC	22A0436T	VLSIDesign	3	0	0	3
4	PEC		**ProfessionalElective-II:**	3	0	0	3
5	OEC		**OpenElective-II:**	3	0	0	3
6	PCC(Lab)	22A0440P	MicroprocessorandMicrocontrollerLab	0	0	3	1.5
7	PCC(Lab)	22A0441P	VLSI DesignLab	0	0	3	1.5
8	PCC(Lab)	22A0442P	DigitalSignalProcessingLab	0	0	3	1.5
9	SC	22A0539	**SkillOrientedCourse:** JAVAProgramming	1	0	2	2
10	MC	22A0032M	**MandatoryCourse:** ResearchMethodology	2	0	0	0
						Totalcredits	**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation							

S.No.	CourseCode	NameoftheProfessionalElective-II
1	22A0437T	ElectronicMeasurementsandInstrumentation
2	22A0438T	Sensors&Actuators
3	22A0439T	RadarandSatelliteCommunications

S.No.	CourseCode	Nameofthe OpenElective-II
1	22A0528T	MachineLearning
2	22A0238Ta	ModernControltheory
3	22A0150T	EnvironmentalEconomics
4	22A0027T	Organizational Behaviour

Category	Credits
ProfessionalCoreCourses(PCC)	13.5
ProfessionalElectiveCourses(PEC)	3
OpenElectiveCourses (OEC)	3
SkillOrientedCourse(SC)	2
Industrial/ResearchInternship(Mandatory)2Months	-
Total	21.5

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Semester–7(Theory-7)							
Sl. No.	Category	Course Code	CourseTitle	Hoursperweek			Credits
				L	T	P	C
1	PEC		**ProfessionalElective-III**	3	0	0	3
2	PEC		**ProfessionalElective-IV**	3	0	0	3
3	PEC		**ProfessionalElective-V**	3	0	0	3
4	OEC		**OpenElectives-III**	3	0	0	3
5	OEC		**OpenElectives-IV**	3	0	0	3
6	HSC		**OpenElective-V:**	3	0	0	3
7	SC	22A0458P	**SkillAdvancedCourse:** MobileApplicationDevelopment	1	0	2	2
8	INT	22A0460	Evaluation of Industry Internship	0	0		3
						Totalcredits	**23**

S.No.	CourseCode	NameoftheProfessionalElectives
1	22A0449T	MobileCommunications
2	22A0450T	LowPowerVLSIDesign
3	22A0451T	EmbeddedRealTimeSystems
4	22A0452T	Fuzzysets,logicsystemsandApplications
5	22A0453T	AdvancedDigitalSignalProcessing
6	22A0454T	InternetofThings
7	22A0455T	CPLD&FPGAArchitecturesandApplications
8	22A0456T	DigitalImageProcessing
9	22A0457T	DigitalTVEngineering

S.No.	CourseCode	NameoftheOpenElectives
1	22A0529T	CloudComputing
2	22A0241Ta	SmartGrid
3	22A0330Ta	MeasurementsandMechatronics
4	22A0151T	DisasterManagement
5	22A0534b	CyberSecurity
6	22A0327Ta	RenewableEnergySources
7	22A0152T	ConstructionManagement
8	22A0232Ta	ElectricVehicles
9	22A0024T	Entrepreneurship&Innovation0
10	22A0023T	ManagementScience
11	22A0026T	BusinessEnvironment
12	22A0033T	HumanResourceManagement

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Category	Credits
ProfessionalElectiveCourses(PEC)	9
HumanitiesandSocialScienceCourse(HSC)	3
OpenElective Courses(OEC)	6
SkillAdvancedCourse(SC)	2
Industrial/ResearchInternship	3
Total	23

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IVYear(Semester–8)							
Sl.No.	Category	Course Code	CourseTitle	Hoursperweek			Credits
1	MajorProject	22A0465P	Project work, Seminar and Internship in industry	0	0	24	12
			Totalcredits				12

TypesofCourses:

Typesof Courses	CourseCategory	Code	Department
Foundation	EngineeringSciences	ESC	24
	BasicSciences	BSC	21
	Humanities&SocialSciencesa nd Management	HSC	13.5
Core	ProfessionalCore	PCC	51
Project	Project&Internship(12)	PROJ	16.5
	Internship(4.5)		
Elective Courses	ProfessionalElective	PEC	15
	OpenElective(includingtwoMOOCs)	OEC	12
Mandatory Courses	Mandatory	MC	-
	SkillOrientedCourses	SC	10
		TotalCredits	163

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COURSES OFFERED FOR HONOR DEGREE BY ECE

Note: 1. The Honor subjects are having a total of 20 additional credits.
2. Students should acquire 4 credits through MOOCs compulsorily to award the Honor Degree.

Sl. No.	Course Code	Name of the Honor Course	Hours per week			Credits
			L	T	P	C
1	22A04H01	Low Power VLSI Circuits and Systems	3	1	0	4
2	22A04H02	Pattern Recognition	3	1	0	4
3	22A04H03	Software Defined Radio	3	1	0	4
4	22A04H04	Micro Electro Mechanical Systems	3	1	0	4
5	22A04H05	Wireless Communications	3	1	0	4
6	22A04H06	VLSI Testing and Testability	3	1	0	4
7	22A04H07	ARM based Embedded System Design	3	1	0	4
8	22A04H08	Semiconductor Device Modelling	3	1	0	4
9	22A04109	Modern Digital Communication Techniques	3	1	0	4
10	22A04110	VLSI Interconnects	3	1	0	4

S. No.	Name of the Honor Subject	Pre-requisite required
1	Low Power VLSI Circuits and Systems	Basics of VLSI
2	Pattern Recognition	Signal Processing, Probability Theory and Graph Theory
3	Software Defined Radio	Background in electrical engineering
4	Micro Electro Mechanical Systems	Basic Electronics
5	Wireless Communications	Principles of Signals and Systems and Principles of Communication Systems
6	VLSI Testing and Testability	Basics of VLSI
7	ARM based Embedded System Design	Embedded Systems
8	Semiconductor Device Modelling	Basic Knowledge on Electronic Devices and Circuits
9	Modern Digital Communication Techniques	Principles of Communication Systems and Digital Communications
10	VLSI Interconnects	Electro-magnetics or Microwave Engineering or EM Waves

COURSES OFFERED FOR MINOR DEGREE BY ECE

Note: 1. The Minor subjects are having a total of 20 additional credits.
2. Students should acquire 4 credits through MOOCs compulsorily to award the Minor Degree.

Sl. No.	Course Code	Name of the Minor Course	Hours per week			Credits
			L	T	P	C
1	22A0401T	Electronic Devices & Circuits	3	1	0	4
2	22A0404T	Signals and Systems	3	1	0	4
3	22A0405T	Digital Logic Design	3	1	0	4
4	22A0416T	Linear IC Applications	3	1	0	4
5	22A0430T	Principles of Communication Systems	3	1	0	4
6	22A0437T	Electronic Measurements and Instrumentation	3	1	0	4
7	22A0432T	Basic VLSI Design	3	1	0	4
8	22A04111	Digital Circuits	3	1	0	4
9	22A04112	Digital Image Processing	3	1	0	4
10	22A04113	Fundamentals of Wireless Communication	3	1	0	4
11	22A04114	Introduction to Semi conductor Devices	3	1	0	4

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B.TECH Electronics & Communication Engineering

Course Structure (RG22)

Semester 0

Induction Program: 3weeks
(Common for All Branches of Engineering)

S.No	Course No	Course Name	Category	L-T-P-C
1		Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2		Career Counselling	MC	2-0-2-0
3		Orientation to all branches -- career options,tools, etc.	MC	3-0-0-0
4		Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5		Proficiency Modules & Productivity Tools	ES	2-1-2-0
6		Assessment on basic aptitude andmathematical skills	MC	2-0-3-0
7		Remedial Training in Foundation Courses	MC	2-1-2-0
8		Human Values & Professional Ethics	MC	3-0-0-0
9		Communication Skills -- focus on Listening,Speaking, Reading, Writing skills	BS	2-1-2-0
10		Concepts of Programming	ES	2-0-2-0

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Course Structure (RG22)

Semester - 1 (Theory-5, Lab-3)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0001T	Linear Algebra and Calculus	3	0	0	3
2	BSC	22A0003T	Applied Physics	3	0	0	3
3	HSC	22A0013T	Communicative English	3	0	0	3
4	ESC	22A0518T	C Programming & Data Structures	3	0	0	3
5	ESC	22A0302T	Engineering Drawing	1	0	4	3
6	HSC (Lab)	22A0014P	Communicative English Lab	0	0	3	1.5
7	BSC (Lab)	22A0008P	Applied Physics Lab	0	0	3	1.5
8	ESC (Lab)	22A0519P	C Programming & Data Structures Lab	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	7.5
Humanities and Social Science Course (HSC)	4.5
Total	19.5

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B.TECH Electronics & Communication Engineering

Course Structure (RG22)

Semester - 2 (Theory-4, Lab-5)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0002T	Differential Equations and Vector Calculus	3	0	0	3
2	BSC	22A0006T	Chemistry	3	0	0	3
3	ESC	22A0201T	Fundamentals of Electrical Circuits	3	0	0	3
4	ESC	22A0401T	Electronic Devices & Circuits	3	0	0	3
5	BSC (Lab)	22A0011P	Chemistry Lab	0	0	3	1.5
6	ESC (Lab)	22A0202P	Fundamentals of Electrical Circuits Lab	0	0	3	1.5
7	ESC (Lab)	22A0402P	Electronic Devices & Circuits Lab	0	0	3	1.5
8	ESC (Lab)	22A0403P	Electronics Workshop	0	0	3	1.5
9	ESC (Lab)	22A0502P	IT Workshop	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	12
Total	19.5

LINEAR ALGEBRA & CALCULUS					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0001T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BS**

Course Objectives:

This course will illuminate the students in the concepts of calculus and linear algebra. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Syllabus		**Total Hours: 45**
Module - I	**Matrices**	**9 Hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Applications: Finding the current in electrical circuits Eigen values and Eigenvectors and their properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of amatrix.

Module - II	**Mean Value Theorems**	**9 Hrs**

Rolle's Theorem (Without Proof), Lagrange's mean value theorem (Without Proof), Cauchy's mean value theorem (Without Proof), related problems, Taylor's and Maclaurin theorems with remainders (without proof) - related problems, Taylor's and Maclaurin series (without proof) Expansions of functions by Taylors and Maclaurin's series.

Module - III	**Multivariable Calculus**	**9 Hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Module - IV	**Multiple Integrals**	**9 Hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Module - V	**Beta and Gamma functions**	**9 Hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions,evaluation of definite integrals using beta and gamma functions.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solving the system of linear equations, find the eigen values and eigenvectors and use thisinformation to facilitate the calculation of matrix characteristics.
- Translate the given function as series of Taylor's and Maclaurin's with remainders, analyzethe behavior of functions by using mean value theorems.
- Acquire the Knowledge maxima and minima functions of several variables. Utilize Jacobian ofa coordinate transformation to deal with the problems in change of variables.
- Apply multiple integration techniques in evaluating areas and volumes bounded by the region.
- Understand beta and gamma functions and its relations, conclude the use of special function in evaluating definite integrals.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal , 44/e, Khanna Publishers, 2017.
2. Linear Algebra & Calculus by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Engineering Mathematics III by N.P. Bali, Dr. K.L. Sai Prasad, University Science Press.

Reference Books:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
3. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S. Chand Publications.

Applied Physics

(Common to ECE, EEE)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
22A0003T	3:0:0:0	3	CIE:30 SEE:70	3H	BS

Prerequisite: Student should know about fundamental and basic principles in physics.

Course Objectives:

This course will enable students to:

- To make a bridge between the physics in school and engineering courses.
- To impart the knowledge in basic concepts of the optical phenomenon like interference, diffraction andpolarization.
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibers along with engineering applications.
- To open new avenues of knowledge and understanding the basic concepts of dielectric and magneticmaterials and its application in the emerging micro devices.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of chargecarriers in semiconductors.
- To identify the importance of semiconductors in the functioning of electronic devices.
- To enlighten the concepts related to superconductivity which leads to their fascinating applications.
- To impart knowledge in basic concepts of electromagnetic waves

Syllabus	Total Hours: 48
Module - I Wave Optics	**10**

Interference- Principle of superposition – Interference of light – Types of Interference – Path difference – Phase difference – Conditions for sustained interference- Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index of liquid.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to singleslit, double slit and N-slits (qualitative) – Grating spectrum**.**

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.	
Module –II Lasers and Fiber optics	**10**
Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Ruby laser – He-Ne laser – Applications of lasers. **Fiber optics-** Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications	
Module –III Dielectric and Magnetic Materials	**10**
Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation. **Magnetic Materials-** Introduction –Basic definitions – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro – Hysteresis – Soft and Hard magnetic materials	
Module –IV Semiconductors and Superconductors	**10**
Semiconductors- Introduction – Classification of crystalline solids – Intrinsic semiconductors – Intrinsic Density of charge carriers- Intrinsic conductivity-Intrinsic Fermi level- Extrinsic semiconductors– p-type and ntype- Drift and diffusion currents – Einstein's equation – Formation of p-n junction diode – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect. **Superconductors-** Introduction – Properties of superconductors – Meissner effect – Type I and TypeII superconductors – BCS theory – Josephson effects (AC and DC) – High T_C superconductors – Applications of superconductors**.**	
Module –V Electrostatics and Electromagnetic Waves	**8**
Electrostatics -Introduction- Electric charge-Coulomb's law-Electric filed-- Electric field due to linear charge-Gauss' law- statement and its proof- Derivation of Coulomb's law from Gauss law. **Electromagnetic Waves-** Introduction-Divergence and Curl of Electric and Magnetic Fields- Stokes' theorem for curl- Maxwell's Equations (Quantitative)- Electromagnetic wave propagation (Non-conducting medium (dielectric medium)) -Poynting's Theorem.	

Course Outcomes:

On completion of this course, the students are able to:

- Describe the importance of Interference, Diffraction and Polarization and the engineering applications as well (L2)
- Demonstrate the properties of lasers and fibre optics to various applications in science and technology (L2)
- Explain the fundamental concepts and theory related to dielectric and magnetic materials (L1)
- Illustrate the functioning of semiconductors in electronic devices (L2)
- Discuss the principles and theory related to superconductors and explore their technological applications(L2)
- Explain the electromagnetic wave propagation and its power in non-conducting medium (L2)

Text Books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. Applied Physics for Engineers- K.Venkataramanan, R. Raja, M. Sundararajan(Scitech) [3,5] 2014

Reference Books:

1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. David J.Griffiths, "Introduction to Electrodynamics"- 4/e, Pearson Education,2014
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

E-resources:

- https://www.textbooks.com/Catalog/MG5/Applied-Physics.php
- https://edurev.in/courses/9596_Electromagnetic-Theory-Notes--Videos--MCQs--PPTs
- https://libguides.ntu.edu.sg/c.php?g=867756&p=6226561
- https://bookauthority.org/books/best-applied-physics-books
- https://www.electronicsforu.com/resources/16-free-ebooks-on-material-science/2

COMMUNICATIVE ENGLISH

(Common to all Branches of Engineering)

Course Code	L:T: P: S	Credits	Exam marks	Exam Duration	Course Type
22A0013T	3: 0: 0: 0	3	CIE:30 SEE:70	3 Hours	HS

Course Objectives:

- Facilitate effective **listening skills** for better comprehension of academic lectures and English spoken by native speakers
- Help improve **speaking skills** motivating the learners to participate in activities such as role plays, discussions and structured talks/oral presentations
- Focus on appropriate **reading skills** for comprehension of various academic texts and authentic materials
- Impart effective strategies for good **writing skills** in summarizing, writing well organized essays, drafting formal letters and designing well structured reports
- Broaden the knowledge base of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Syllabus — **Total Hours:48**

Module - I	On the Conduct of Life: William Hazlitt	9 Hrs

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text Scanning to look for specific pieces of information.
Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.
Grammar and Vocabulary: Parts of Speech,
Content words and function words;
Word order in sentences;
Basic sentence structures;
Types of questions - Wh- questions.

Module - II	The Brook: Alfred Tennyson	9Hrs

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
Grammar and Vocabulary: Use of Articles and zero Article
Prepositions
Punctuation, capital letters
Cohesive devices - linkers

Module - III	The Death Trap: Saki	11 Hrs

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Paragraph Writing , Summarizing
Grammar and Vocabulary: Verbs - Tenses
Subject-Verb agreement
Direct & Indirect speech

Module - IV	Ponnuthayi – Bama	10 Hrs

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Read and Interpret graphic Information to reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters/Report Writing
Grammar and Vocabulary: Adjectives and Adverbs; Comparing and Contrasting
Voice - Active & Passive Voice.

Module - V	My Beloved Charioteer- Shasi Deshpande	9 Hrs

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts- without the use of PPT slides
Reading: Reading for Comprehension
Writing: Writing structured essays on specific topics using suitable claims and evidences.
Grammar and Vocabulary: Identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Course Outcomes (CO):

On completion of this course, student will be able to

- Retrieve the knowledge of basic grammatical concepts.
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English.
- Apply grammatical structures to formulate sentences and correct word forms.
- Analyze discourse markers to speak clearly on a specific topic in informal discussions.
- Evaluate listening /reading texts and to write summaries based on global comprehension of these texts.
- Create and develop coherent paragraph interpreting graphical description.

Textbooks:

1) Language and Life: English Skills for Engineering Students - Orient Black Swan

Reference Books:

1. 1. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)

Web links:

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html

C-PROGRAMMING & DATA STRUCTURES

Common to(ECE,EEE,ME,CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0502T	3: 1:0:0	3	CIE: 30SEE:70	3Hours	ESC

Course Objectives:

This course will enable students to:

- Illustrate the basic concepts of C programming language.
- Choose a suitable C-construct to develop C code for a given problem.
- Illustrate the fundamental concept of data structures and Arrays.
- Emphasize the importance of data structures in developing and implementing efficient. algorithms.
- Illustrate a variety of data structures such as linked structures, stacks, queues, trees, and graphs.

Syllabus		Total Hours:45
Unit - I	**Introduction to C Language**	**9Hrs**

Structure of C program, C Tokens, Data types, Operators, Precedence and Associativity of operators, Expressions and its evaluation, control structures – sequence, selection and Iteration statements, unconditional control structures – break, goto, continue. Arrays: Introduction to arrays, types of arrays, applications of arrays, Programming examples

Unit - II	**Strings, Functions and Pointers**	**9Hrs**

String: Declaring and Initializing string, Printing and reading strings, string manipulation functions, String input and output functions, array of strings, Programming examples

Functions: Defining function, user defined functions, standard functions, passing array as argument to function, recursion

Pointers: declaring and initializing pointers, pointers and arrays, pointer to pointer, pointer arithmetic, dynamic memory allocation,

Structures and Unions

Unit - III	**Data Structures**	**9Hrs**

Introduction to Data Structures: Definitions, Concept of Data Structures, Overview of Data Structures, Implementation of Data Structures

Linked Lists: Definition, Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked List, Applications of Linked List

Unit - IV	**Stacks & Queues**	**9Hrs**

Stacks: Introduction, Definition, Representation of Stack, Operations on Stacks, Applications of Stacks

Queues: Introduction, Definition, Representation of Queues, Operations on Queues, Various Queue Structures, Applications of Queues.

Unit - V	Trees ,Graphs ,Searching and Sorting	9Hrs

Trees: Basic Terminologies, Definition and Concepts, Binary Tree, Representation of Binary Tree, operations on Binary Tree, Binary Search Tree, Heap Tree

Graphs: Introduction, Graph Terminologies, Representation of graphs, Operations on Graphs, Graph, Graph Traversal Techniques: BFS and DFS

Searching and Sorting – sequential search, binary search, exchange (bubble) sort, selection sort,

insertion sort.

Course Outcomes(CO):

On completion of this course, student will be able to

- Illustrate and explain the basic computer concepts and programming principles of C language(L2)
- Select the best selection and loop construct for solving given problem(L2)
- Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings.(L2)
- Implement basic operations on stack and queue using array representation(L2)
- Use linked structures, trees, and Graphs in writing programs(L2)
- Demonstrate different methods for traversing Graphs and Trees (L2)

Text Books:

1. C Programming & Data Structures – Behrouz A. Fourazan, Richard F. Gilberg.
2. Programming with C – Byron Gottfried, Third edition, Scham's Outlines
3. C Programming : A Problem Solving Approach- Behrouz A. Fourazan , E.V.Prasad, Richard F. Gilberg
4. Classic Data Structures , Second Edition, Debasissamanta, PHI
5. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S.Sahni and Susan Anderson Freed, Universities Press

Reference Books:

1. Let us C,YashwantKanetkar, 6th Edition , BPB
2. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
3. C Programming, E.Balagurusamy, 3rd edition, TMHPublishers
4. Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
5. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.
6. "Data Structures and Algorithm Analysis in C" by Weiss
7. "Data Structure Through C" by Yashavant P Kanetkar

E-resources:

https://www.geeksforgeeks.org/c-programming-language/

http://en.cppreference.com/w/c

https://onlinecourses.nptel.ac.in/noc19_cs42/

https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/index.html

https://codeforwin.org/

Engineering Drawing

Course Code	L:T:P/D:C	Course Type
22A0302T	1: 0: 0/4 :3	ESC

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Syllabus		Total Hours:50
Unit - I	**Introduction to Engineering Drawing**	**10 Hrs**

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance- Conventions in drawing-lettering - BIS conventions.

a) Draw the Conic sections including Ellipse, Parabola, Hyperbola, and the Rectangular hyperbola using general methods,

b) Draw the Cycloid, Epicycloids, and Hypocycloid

c) Draw the Involutes of circle, square, pentagon, and hexagon

Unit - II	Projections of points, lines and planes	10 Hrs

Projections of points, lines, and planes: Projection of points in any quadrant, lines inclined to one and both planes, finding true lengths, finding true inclinations, angle made by line. Projections of regular plane surfaces using rotating plane method.

Unit - III	Projections of Solids	10 Hrs

Projections of solids: Projections of regular solids inclined to one and both the principle planes using auxiliary views method.

Unit - IV	Sections of solids	10 Hrs

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Unit - V	Development of surfaces	10 Hrs

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Course Outcomes (CO):

On completion of this course, student will be able to

- Draw various curves applied in engineering. (l2)
- Show projections of solids and sections graphically. (l2)
- Draw the development of surfaces of solids. (l3)

Textbooks:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

COMMUNICATIVE ENGLISH LAB

(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0014P	**0:0:3:0**	**1.5**	**CIE:30 SEE:70**	**3H**	**HS**

Course Objectives

This course will enable students to:

- Students will be exposed to a variety of self instructional, learner friendly modes of language learning
- Students will learn better pronunciation through sounds, stress, intonation and rhythm
- Students will be trained to use language effectively to face interviews, group discussions, public speaking
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

List of Experiments | Total Hours: 48

1. Phonetics
2. Describing objects/places/persons
3. Role Play or Conversational Practice
4. JAM
5. Etiquettes of Telephonic Communication
6. Group Discussions
7. Debates
8. Oral Presentations
9. Interviews Skills
10. Reading comprehension
11. E-mail Writing
12. 12.Resume Writing

Course Outcomes:

On completion of this course, the students are able to:

- Listening and repeating the sounds of English Language
- Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, syllable division, stress, rhythm, intonation for better Listening and Speaking Comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to Improve fluency in spoken English.

Suggested Software: Walden InfoTech / Young India Films

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T. Balasubramanyam

Online Learning Resources/Virtual Labs:

www.esl-lab.com

www.englishmedialab.com

www.englishinteractive.net

Applied Physics Lab

(Common to ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0008P	0:0:3:0	1.5	CIE:30 SEE:70	3H	BS

Course Objectives:

This course will enable students to:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and materials applications.
- Apply the principles of semiconductors in various electronic devices

Syllabus	Total Hours: 48

Note: In the following list, out of 12 experiments, any 2 experiments must be performed in a virtual mode

List of Experiments

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find itsacceptance angle
8. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
10. To determine the resistivity of semiconductor by Four probe method
11. To determine the energy gap of a semiconductor
12. Determination of Hall voltage and Hall coefficient of a given semiconductor using HallEffect.

Course Outcomes:

On completion of this course, the students are able to:

- Determine the radius of a curvature and / or thickness of thin wire using microscope with the help of interference concept (L2)
- Evaluate the wavelength of various colors of grating and also dispersive power of prism by spectrometer using the principle of diffraction (L2)
- Evaluate wavelength of light source and particle size with He-Ne laser using the principle of diffraction Estimate the numerical aperture of a given optical fiber and hence to find its acceptance angle (L2)
- Estimate the dielectric constant of a given material (L2)
- Examine the hysteresis loss of the magnetic material by B- H curve and Estimate the magnetic field of a circular coil carrying current along the axis (L2)
- Measure the type of conductivity ,hall voltage and hall coefficient of a given semiconductor using hall effect and also measure the energy band gap of a given semiconductor material (L2)

Text Books:

1. Engineering Practical Physics B Mallick S Panigrahi, 1st, Edition, Cengage Learning Publishers

2. A Text book of Engineering Physics Practical, Dr. Ruby Das, Dr. Rajesh Kumar, C. S. Robinson,Prashant Kumar Sah, UNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.)

Reference Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S ChandPublishers, 2017

E-resources:

http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University
https://www.scribd.com/doc/81569075/Physics-Lab-Manual
http://www.mlritm.ac.in/assets/img/Lab%20manual%20Physics.pdf
https://bmsit.ac.in/public/assets/pdf/physics/studymaterial/Physics%20lab%20manual_cbcs%20%20-%20kavichintu.pdf

C-PROGRAMMING & DATA STRUCTURES LAB (Common to ECE, EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0502P	**0:0:3:0**	**1.5**	**CIE:30 SEE:70**	**3Hours**	**ESC**

Course Objectives:

This course will enable students to:

- Work with an IDE to create, edit, compile, run and debug programs
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Design & develop of C programs using arrays, strings, pointers & functions.
- Exploring basic data structures such as stacks and queues.
- Introduces variety of data structures such as hash linked list, trees and graphs.
- Introduces searching and sorting algorithms.

Syllabus	**Total Hours: 48**

List of Experiments

1. a) Write an algorithm to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).

b) Write an algorithm to calculate area and Circumference of a circle.

c) Write an algorithm to calculate simple interest for a given P, T, and R (SI = P*T*R/100)

2.a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

3 a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n characters from a given position in a given string.

4 a) Write a C program to find sum and average of three numbers.

b) Write C program to evaluate each of the following equations

5a) Write a program in C to print individual characters of string in reverse order.

b) Write a program in C to compare two strings without using string library functions.

c) Write a C program to determine if the given string is a palindrome or not

6 . a) Write C program to find GCD of two integers by using recursive function.

b) Write C program to find GCD of two integers using non-recursive function

7 .Write C programs that implement stack (its operations) using

i) Arrays ii) Pointers

8. Write C programs that implement Queue (its operations) using

i) Arrays ii) Pointers

9. Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression

10. Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

11. Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

12. Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

13 .Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

14. Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

i) Linear search ii) Binary search

15 .Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort

Course Outcomes:

On completion of this course, the students are able to:

- Use conditional and iterative statements for writing the C programs(L2)
- Make use of different data-structures like arrays, strings, structures for solving problems.(L2)
- Use basic data structures such as arrays, Stacks and Queues
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals
- Use various searching and sorting algorithms.
- Use linked structures, trees, and Graphs in writing programs

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Classic Data Structures , Second Edition, Debasissamanta, PHI

Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S.Sahni and Susan Anderson Freed, Universities Press

Reference Books:

1. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
2. C Programming, E.Balagurusamy, 3rd edition, TMHPublishers
3. .Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
4. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.
5. "Data Structures and Algorithm Analysis in C" by Weiss
6. "Data Structure Through C" by Yashavant P Kanetkar

"Problem Solving in Data Structures and Algorithms Using C: The Ultimate Guide to Programming Interviews" by Hemant Jain

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

B.TECH Electronics & Communication Engineering

Course Structure (RG22)

Semester - 2 (Theory-4, Lab-5)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0002T	Differential Equations and Vector Calculus	3	0	0	3
2	BSC	22A0006T	Chemistry	3	0	0	3
3	ESC	22A0201T	Fundamentals of Electrical Circuits	3	0	0	3
4	ESC	22A0401T	Electronic Devices & Circuits	3	0	0	3
5	BSC (Lab)	22A0011P	Chemistry Lab	0	0	3	1.5
6	ESC (Lab)	22A0202P	Fundamentals of Electrical Circuits Lab	0	0	3	1.5
7	ESC (Lab)	22A0402P	Electronic Devices & Circuits Lab	0	0	3	1.5
8	ESC (Lab)	22A0403P	Electronics Workshop	0	0	3	1.5
9	ESC (Lab)	22A0502P	IT Workshop	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	12
Total	19.5

Differential Equations & Vector Calculus					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0002T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BS**

Course Objectives:

To enlighten the learners in the concept of differential equations and multivariable calculus, to furnishthe learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Syllabus		**Total Hours:45**
Module - I	**Linear Differential Equations of Higher Order(Constant Coefficients)**	**9 Hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskean, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Module - II	**Partial Differential Equations**	**9 Hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method. Non linearequations of first order – Type I, II, III, IV.

Module - III	**Applications of Partial Differential Equations**	**9 Hrs**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation (Without Derivation), Solutions one Dimensional Wave equation by the method of separation of variables and related Problems.

Module - IV	**Vector Differentiation**	**9 Hrs**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Module - V	**Vector Integration**	**9 Hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solve the linear differential equations with constant coefficients by appropriate method.
- Apply a range of techniques to find solutions of standard partial differential equations.
- Calcify the PDE, learn the applications of PDEs
- Apply del to Scalar and vector point functions, illustrate the physical interpretation of Gradient, Divergence and Curl.
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals.

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Differential Equations & Vector Calculus by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganathamand M.V.S.S.N.Prasad S. Chand publication.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
3. Engineering Mathmatic I & II, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.

CHEMISTRY(Common to CSE,AI&ML,CS,ECE,EEE,DS)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0006T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BS**

Course Objectives: Student will be able to

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods

	Syllabus	**Total Hours: 48 Hrs**
Module- I	**Structure and Bonding**	**9Hrs**

Planck's quantumtheory,dualnatureofmatter,Schrodingerwaveequation,significanceofΨ and Ψ^2, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Module-II	**Modern Engineering materials**	**10Hrs**

Coordination compounds: Crystal field theory – salient features – splitting of d-orbitals in octahedral and tetrahedralgeometry.

Basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on bandstructures.

Supercapacitors: Introduction, Basic concept-Classification – Applications.

Nano chemistry: Introduction, classification of nanomaterials, properties and applications ofFullerenes, andcarbon nanotubes.

Module-III	**Electrochemistry and Applications**	**10Hrs**

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode);Electrochemicalcell,Nernstequation,cellpotentialcalculationsandnumericalproblems, potentiometry- potentiometric titrations (redox titrations), conductometric titrations (acid-base titrations).

Primary cells: Zinc-air battery, Secondary cells: lead acid and lithium-ion batteries-working of the batteries including cell reactions, Fuel cells: hydrogen-oxygen, methanol -oxygen fuel cells – working principle of the cells.

Module-IV	**Polymer Chemistry**	**10Hrs**

Introduction to polymers, functionality of monomers, Types of polymerization-addition, condensation and copolymerization with specific examples and mechanisms of polymerization.

Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of – PTFE, Bakelite, Calculation of molecular weight of polymer by weight average and number average method, Polydispersity Index.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.

Biodegradable polymers: polylactic acid, poly dioxanone, starch, cellulose.

Module-V	**Instrumental Methods and its applications**	**9Hrs**

EMR spectra, Beer-Lambert's law, Basic Principle, Instrumentation and applications of UV-visible spectrophotometer and FTIR, Chromatography-Introduction**,** Principle and instrumentation of Gas Chromatography (GC),retention time, TLC, R_f factor.

Course Outcomes (CO): After completion of the course, students will be able to

- Describe Planck's quantum theory, dual nature of matter, Schrodinger equation, molecular orbital Theory and molecular orbital energy level diagram of different molecules
- Explain Crystal field theory, splitting in octahedral and tetrahedral geometry and the magnetic behaviour, Oxidation state, coordination and colour of complexes.
- Explain the principle of Band diagrams of conductors, superconductor, semiconductors and insulator and nonmaterial
- Discuss the principles of electrochemistry in potentiometry, conductometry, battery and electrochemical sensors
- Explain polymerization and the preparation, properties, and applications of thermoplastics &thermosetting, elastomers, & conducting polymers
- Discuss the different applications of analytical instruments

Textbooks:

1. P. C. Jain & Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company
   (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandriah, Engineering Chemistry, Mc.Graw Hill Publishers, New Delhi.
3. Energy scenario beyond2100,by S.Muthu Krishna Iyer.

ReferenceBooks:

1. J. D. Lee, Concise Inorganic Chemistry, Oxford University Press, 5th edition 2010.
2. Skoog and West, Principles of Instrumental Analysis, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, Atkins' Physical Chemistry, Oxford University Press, 10th edition, 2010.

FUNDAMENTALS OF ELECTRICAL CIRCUITS (common to EEE&ECE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
	3: 0:0:0	**3**	**CIE: 30 SEE:70**	**3Hours**	**BS**

Course Objectives: Student will be able to

1. Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
2. Basics of Magnetic circuits
3. Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree
4. The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference.
5. Network theorems and their applications

Unit - I	**Introduction to Electrical Circuits**	**10 Hrs**

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage – Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation, Nodal Analysis, Mesh Analysis, Examples.

Learning Outcomes:

At the end of this unit, the student will be able

1. To know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks
2. To know about voltage source to current source and vice-versa transformation in their representation
3. To understand analysis of Nodal and Mesh analysis for different circuits.

Unit - II	**Introduction to Magnetic Circuits**	**8 Hrs**

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

1.To understand Faraday's laws

2.To distinguish analogy between electric and magnetic circuits

3. To understand analysis of series and parallel magnetic circuits.

Unit - III	**Graph theory**	**9 Hrs**

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources, Network equilibrium equations -Duality & Dual Networks.

Learning Outcomes:

At the end of this unit, the student will be able

1. To understand basic graph theory definitions which are required for solving electrical circuits
2.To understand about loop current method
3. To understand about nodal analysis methods
4. To understand about principle of duality and dual networks
5. To identify the solution methodology in solving electrical circuits based on the topology

Unit - IV	**Single Phase A.C Circuits**	**11 Hrs**

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations,Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal

Excitation - Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples. Resonance.

Learning Outcomes:
At the end of this unit, the student will be able
1. To understand fundamental definitions of 1-ϕ AC circuits
2. To distinguish between scalar, vector and phasor quantities
3. To understand voltage, current and power relationships in 1-ϕ AC circuits with basic elements R, L, and C.
4. To understand the basic definitions of complex immittances and complex power
5. To solve 1-ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

Unit - V	**Network Theorems**	**10 Hrs**

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

Learning Outcomes:
At the end of this unit, the student will be able
1. To know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it.
2.To distinguish between various theorems and inter-relationship between various theorems
3. To know about applications of certain theorems to DC circuit analysis
4. To know about applications of certain theorems to AC network analysis
5. To know about applications of certain theorems to both DC and AC network analysis

Course Outcomes (CO): After completion of the course, students will be able to

- Explain types of networks and Network Reduction Techniques
- Analyze Magnetic Circuits and Coupled circuits.
- Analysis of electrical networks using graph theory and duality and dual networks
- Analyze RLC circuits with AC Excitation
- Analyze the power, voltage and current for different network configurations.
- Apply theorems for finding the solutions of network problems

Textbooks:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.

Reference Books:

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

Electronic Devices and Circuits					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0401T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs.
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Syllabus

Unit –I

Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions. **Applications:** Rectifiers – Half wave, Full wave rectifier and Bridge rectifier. Filters - Inductor, Capacitor, L-section and π-Filters, Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Diode as switch, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.

Unit –II

Bipolar Junction Transistors (BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Problem Solving.

Unit –III

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics– i_D - v_{DS} characteristics, i_D – v_{GS} characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

Unit –IV

Biasing of BJT's & MOSFET's: Biasing of BJT's – load line, operating point, fixed bias, self bias, voltage divider bias circuits, Bias compensation, Thermal runaway, condition for Thermal stability, Biasing of MOSFET's - Fixed bias, Self bias, Voltage divider bias circuits, Problem solving.

Unit –V

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Problem solving.

Text Books:

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits – Theory and Applications", 6th Edition, Oxford Press, 2013.
2. Donald A Neamen, "Electronic Circuits – analysis and design", 3rd Edition, McGraw Hill (India), 2019.

References:

1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.

Course Outcomes:

After the completion of the course students will able to

1. Understand principle of operation, characteristics and applications of Semiconductor diodes.
2. Design the diode applications such as rectifiers, clippers and clampers.
3. Understand principle of operation, characteristics and applications of Bipolar Junction Transistor and MOSFETs.
4. Design amplifiers using BJTs, and MOSFETs.
5. Solve the problems related to Semiconductor diodes, BJTs, and MOSFETs.
6. Analyze performance of diode applications, biasing circuits of BJTs, MOSFETs and their applications.

Chemistry Lab

(**Common to CSE,AI&ML,CS,ECE,EEE,DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0011P	**0:0:1.5:0**	**1.5**	**CIE:30 SEE:70**	**3H**	**BS**

Course Objectives:

This course will enable students to:

- Theobjectiveofthelaboratorysessionsistoenablethelearnerstogethands-onexperienceontheprinciples discussed in theory sessions and to understand the applications of these concepts in engineering.

Syllabus	Total Hours: 48

List of Experiments

1. Conduct metric titration of strong acid vs. strong base,
2. Determination of cell constant and conductance of solutions
3. Potentiometry - determination of redox potentials and emfs
4. pH metric titration of strong acid vs. strong base
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Verification of Lambert-Beer's law
8. Preparation of Nanomaterials
9. Separation of organic mixtures by Thin Layer chromatography
10. Identification of simple organic compounds by IR.
11. Estimation of Ferrous Iron by Dichrometry.
12. Determination of Copper by EDTA method.

(**Any 10 experiments from the above list)**

Course Outcomes:

On completion of this course, the students are able to:

- Determine the cell constant and conductance of solutions and the strength of an acid by conductometry
- Synthesize of advanced polymer materials
- Measure the strength of an acid present in secondary battery and Ferrous ion using volumetric analysis
- Determine the potentials and EMFs of solutions byPotentiometry
- Identify some organic and inorganic compounds by instrumental methods
- Synthesize of nanomaterials by simple methods

Text Book(s):

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapathrai Publications., 2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition, 2008.

Reference Book(s):

1. S.K. Bhasin and Sudha Rani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
2. Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria& Sons, New Delhi, 2nd edition.

FUNDAMENTALS OF ELECTRICAL CIRCUITS LABORATORY
(Common to EEE & ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0011P	0:0:3:0	1.5	CIE:30 SEE:70	3H	ESC

Course Objectives:

This course will enable students to:

1. Remember, understand and apply various theorems and verify practically.
2. Understand and analyze active, reactive power measurements in three phase balanced & un balanced circuits

Syllabus	Total Hours: 48

List of Experiments

1. Verification of Kirchhoff's current law and voltage law using hard ware
2. Verification of mesh analysis using hard ware and digital simulation.
3. Verification of nodal analysis using hard ware
4. Determination of average value, rms value, form factor, peak factor of sinusoidal wave, square wave using hard ware
5. Analyse Series and Parallel RLC circuits.
6. Verification of Series and Parallel Resonance
7. Verification of Thevenin's and Norton's Theorems
8. Verification of Superposition Theorem
9. Maximum Power Transfer Theorem for DC and AC circuits
10. Verification of Compensation Theorem for DC circuits
11. Verification of Reciprocity, Millmann's Theorems for DC circuits
12. Determination of Self, Mutual Inductances and Coefficient of Coupling

(**Any 10 experiments from the above list)**

Course Outcomes:

On completion of this course, the students are able to:

1. Analyze network parameters and types of networks
2. Analyze RLC circuits and coupled circuits.
3. Analyze Resonance for different circuits.
4. Apply theorems for finding the solutions of network problems
5. Apply Maximum power transfer theorems for finding the solutions of DC & AC Networks
6. Analyze coupled circuits.

Text Book(s):

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

Reference Book(s):

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. 2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. 3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. 4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

ELECTRONIC DEVICES AND CIRCUITS LAB					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0402P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyse the characteristics of Diodes, BJT, MOSFET.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

Syllabus

LIST OF EXPERIMENTS: (Conduct all experiments).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Design a half wave rectifier with and without filters for the given specifications, and verify the results experimentally for different load conditions, also Calculate ripple factor with relevant graphs.
2. Design a full wave rectifier with and without filters for the given specifications, and verify the results experimentally for different load conditions, also Calculate ripple factor with relevant graphs
3. Verify the operation of various clipping and clamper circuits using PN junction diode experimentally.
4. Design a voltage regulator using Zener diode and verify load regulation characteristics.
5. Analyze the input and output characteristics of BJT in Common Emitter configuration experimentally.
6. Analyze the input and output characteristics of BJT in Common Base configuration experimentally.
7. Design voltage- divider bias/self-bias circuit using BJT and verify experimentally.
8. Design a small signal amplifier using BJT (common emitter) for the given specifications also calculate Bandwidth.
9. Analyze the output and transfer characteristics of MOSFET in Common Source Configuration experimentally.
10. Design self-bias circuit using MOSFET and verify experimentally.
11. Verify the operation of a switch using CMOSFET/JFET/BJT experimentally.
12. Design a small signal amplifier using MOSFET (common source) for the given specifications also calculate Bandwidth.

Tools / Equipment Required: Software Tool like Multisim/ Pspice or Equivalent,
DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Course Outcomes:

After the completion of the course students will able to

1. Understand the operation and characteristics of basic electronic devices.
2. Design the Diode applications like Rectifiers, Clippers and Clampers for the given specifications**.**
3. Analyze the Characteristics of Diodes, BJTs, MOSFETs.
4. Design BJT based amplifiers for the given specifications.
5. Design MOSFET based amplifiers for the given specifications
6. Simulate Diode, BJT and MOSFET applications in PSPICE /Multisim.

ELECTRONICS WORKSHOP

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0403P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- To introduce electronic components, measuring instruments and tools used in electronic workshop.
- To equip with the knowledge of understanding data sheets of electronic components.
- To give practical experience on soldering the electronic components on a PCB.
- To introduce EDA tools.
- To know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide training on Productivity tools like word processors, spreadsheets, presentations.

Syllabus

List of Exercises / Experiments:

1. Familiarization of commonly used Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that electronics hardware tools and instruments are learned to be used by the students

2. Familiarization of Electronic Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that electronic measuring instruments are learned to be used by the students

3. Electronic Components: Familiarization/Identification of electronic components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, color coding, package, symbol, cost etc.

4. Testing of electronic components like Resistor, Capacitor, Diode, Transistor, ICs etc.
   - Compare values of components like resistors, inductors, capacitors etc with the measured values by using electronic instruments

5. Study of Cathode Ray Oscilloscope (CRO)
   - Find the Amplitude and Frequency of a signal
   - Measure the Unknown Frequency & Phase difference of signals using Lissajous figures

6. Interpret data sheets of discrete components and IC's.
   - Write important specifications/ratings of components & ICs and submit it in the form of a report

7. Introduction to EDA Tools: MULTISIM/PSPICE/TINA schematic capture tool, learning of basic functions of creating a new project, getting and placing parts, connecting placed parts, simulating the schematic, plotting and analyzing the results.
Provide some exercise so that students are familiarized in using EDA tools

8. Assembling and Testing of simple electronic circuits on breadboards; identifying the components and its location on the PCB, soldering of the components, testing the assembled circuit for correct functionality.

Course Outcomes:

- Identify discrete components and ICs.
- Assemble simple electronic circuits over a PCB.
- Test various components.
- Interpret specifications (ratings) of the component.

IT WORKSHOP					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0502P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors Spreadsheets, Presentations and LAteX
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Syllabus

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process. Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using

it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc. Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Basic Electrical and Electronics Engineering

(Common for all branches excluding EEE & ECE)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0240P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PC

Course Objectives:

To get practical knowledge about basic electrical circuits, electronic devices like Diodes, BJT, JFET and also analyze the performance of DC Motors, AC Motors and Transformers.

Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

Equipment Required:

1. Verification of Kirchhoff's Laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of DC Shunt Generator.
4. Brake Test on DC-Shunt Motor. Determination of Performance curves.
5. OC & SC Tests on Single Phase Transformer.
6. V-I Characteristics of Solar Cell
7. V-I Characteristics of PN junction Diode
8. V-I Characteristics of Zener Diode
9. Half Wave Rectifier and Full Wave rectifier.
10. Input and Output characteristics of BJT with CE configuration
11. Input and Output characteristics of BJT with CB configuration
12. Input and Output Characteristics of JFET.

Additional Experiments:

13. Speed control of DC Shunt Motor
14. Brake Test on Three Phase Induction Motor.

Course Outcomes:

After the completion of the course students will able to,

1. Experimentally verify the basic circuit theorems, KCL and KVL
2. Draw the Open circuit characteristics of DC Shunt Generator circuits experimentally.
3. Acquire hands on experience of conducting various tests on dc shunt motor, single phase transformers obtaining their performance indices using standard analytical as well as graphical methods
4. Experimentally verify the V-I characteristics of Solar cell
5. Draw the characteristics of different semiconductor devices like PN junction Diode, Zener Diode, BJT and JFET by conducting suitable experiments.
6. Experimentally verify the working of half and full wave rectifier by using PN Junction diodes

Semester - 3 (Theory-7, Lab-3, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0015T	Complex Variables & Numerical Methods	3	0	0	3
2	BSC	22A0020T	Probability Theory and Stochastic Processes	3	0	0	3
3	PCC	22A0404T	Signals and Systems	3	0	0	3
4	PCC	22A0405T	Digital Logic Design	3	0	0	3
5	HSC	22A0021T	Universal Human Values	3	0	0	3
6	PCC	22A0406T	Analog Circuits	3	0	0	3
7	PCC (Lab)	22A0407P	Simulation Lab	0	0	3	1.5
8	PCC (Lab)	22A0408P	Digital Logic Design Lab	0	0	3	1.5
9	PCC (Lab)	22A0409P	Analog Circuits Lab	0	0	3	1.5
10	SC	22A3205	**Skill Oriented Course:** Python Programming	1	0	2	2
11	MC	22A0029M	**Mandatory Course:** Constitution of India	2	0	0	0
			Total credits				**24.5**

Category	**Credits**
Basic Science Course (BSC)	6
Professional Core Courses (PCC)	13.5
Humanities and Social Science Course (HSC)	3
Skill Oriented Course (SC)	2
Total	24.5

COMPLEX VARIABLES AND NUMERICAL METHODS
(Common to EEE, ECE, ME)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0015T	3: 0:0:0	3	CIE: 30 SEE:70	3Hours	BSC

Course Objectives:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables, various numerical methods for interpolating the polynomials, evaluation of integral equations and solution of differential equations.

Syllabus **Total Hours:45**

Unit - I	Analytic Functions And Conformal Mapping	9 Hrs

Differentiation, Analytic functions, Cauchy-Riemann equations (both Cartesian and polar), Harmonic functions, and Harmonic conjugate, Potential functions.

Unit - II	Complex Integration	9 Hrs

Line integrals, Cauchy's theorem (without proof), Cauchy's integral formula (without proof), Generalized Cauchy's integral formula (without proof), Complex Power Series: Taylor's series and Laurent's series (without proof), zeros of an analytic functions, Singularities: Types of singularities, pole of order.

Unit - III	Residue Theorem	9 Hrs

Residues and evaluation of residues at poles, Cauchy's Residue theorem (without proof), Evaluation ofintegrals using residue theorem, Evaluation of improper and real integrals of the type:

(i) $\int_c^{2} f(\cos\sin)\, d$ (ii) $f(x)\, dx$

Unit - IV	Interpolation-Numerical Differentiation & Integration	9 Hrs

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Numerical Differentiation & Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Unit - V	Numerical Solution of Ordinary Differential Equations	9 Hrs

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method ofsuccessive Approximations-Modified Euler's Method-Runge-Kutta Methods.

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics Volume III by T.K.V. Iyengar, B.Krishna Gandhi,S.Ranganatham and M.V.S.S.N. Prasad, S. Chand Publications.
3. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd., New

References:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Course Outcomes (CO):

On completion of this course, student will be able to:

CO-1: Understand functions of Complex variable and its properties,

CO-2: Understand analyticity & conformal mappings of complex functions.

CO-3: Understand the integration of complex functions; apply Cauchy's integral theorem and Cauchy's integral formula, singularities of complex functions.

CO-4: Evaluate improper integrals of complex functions using Residue theorem.

CO-5: Derive interpolating polynomials using interpolation formulae and evaluate the differentiation and integration numerically.

CO-6: Solve differential and integral equations numerically.

PROBABILITY THEORY AND STOCHASTIC PROCESSES					
Course Code	**L: T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0020T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

- This gives basic understanding of random signals and processes signal
- To understand the principles of random signals and systems in Communications andSignal Processing areas.
- To know the Spectral and temporal characteristics of Random Processes.
- To Learn the Basic concepts of Noise sources.

Syllabus	**Total Hours:48**
Unit –I	**10 Hrs**

Probability: Probability Introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events, Problem Solving.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties, Problem Solving.

Unit –II	**10 Hrs**

Operations on Single Random Variable: Introduction, Expectation of a random variable, moments-moments about the origin, Central moments, Variance and Skew, Chebyshev's inequality, moment generating function, characteristic function, transformations of random variable, Problem Solving.

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected), Unequal Distribution, Equal Distributions, Problem Solving.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties of Gaussian random variables, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables, Problem Solving.

Unit –III	**10 Hrs**

Random Processes-Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, N-Order and Strict-Sense Stationarity. Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process, Problem Solving.

Unit –IV	**9 Hrs**

Random Processes-Spectral Characteristics: The Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum and its Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Problem Solving.

Unit –V	9 Hrs

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties, Problem Solving.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Principles of Communication systems by Taub and Schilling (TMH), 2008.

References:

1. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002.
2. Simon Haykin, "Communication Systems", 3rd Edition, Wiley, 2010.
3. Henry Stark and John W.Woods, "Probability and Random Processes with Application to Signal Processing," 3rd Edition, Pearson Education, 2002.
4. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis," 3rd Edition, Oxford, 1999.

Course Outcomes:

After the completion of the course students will able to:

CO-1: Understanding the concepts of Probability, Random Variables, Random Processes and their characteristics learn how to deal with multiple random variables, conditional probability, joint distribution and statistical independence.

CO-2: Formulate and solve the engineering problems involving random variables and random processes.

CO-3: Analyze various probability density functions of random variables.

CO-4: Derive the response of linear system for Gaussian noise and random signals as inputs.

CO-5: Understand and analyze continuous and discrete-time random processes.

CO-6: Evaluate the single and multiple random variable concepts to expectation, variance and moments.

SIGNALS AND SYSTEMS					
Course Code	**L: T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0404T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**
Pre-requisite		**Mathematics - I**			

Course Objectives:

- To introduce students to the basic idea of signal and system analysis and its characterization in timeand frequency domains.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To analyze characteristics of linear systems in time and frequency domains.
- To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

UNIT - I	Signals, Systems and Fourier Series	10 Hrs

Signals & Systems: Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Important sets & symbols, Signal Analysis .Analogy between vectors andsignals-Orthogonality, mean square error.

Fourier series (FS): Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.d

UNIT - II	CTFT and DTFT	10 Hrs

Continuous Time Fourier Transform (CTFT): Definition, Computation and properties of Fourier Transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

Discrete Time Fourier Transform (DTFT): Definition, Computation and properties of Discrete TimeFourier transform for different types of signals and systems.

UNIT - III	Laplace Transform	10 Hrs

Laplace Transform (LT): Definition, ROC, Properties, Inverse Laplace transforms, the S-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

UNIT - IV	Signal Transmission through LTI systems	9 Hrs

Signal Transmission through Linear Systems: Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems.

UNIT - V	Z-Transform	9 Hrs

Z–Transform (ZT): Definition, ROC, Properties, Poles and Zeros in Z-plane, The inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions. Illustrative Problems.

Text Books:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI,2009.
2. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, Wiley, 2005

Reference Books:

1. BP Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press,015.

Matthew Sadiku and Warsame H. Ali, "Signals and Systems A primer with MATLAB", CRCPress, 2016.

2. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

Matthew Sadiku and Warsame H. Ali, "Signals and Systems A primer with MATLAB", CRCPress, 2016.

2. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

Course Outcomes (CO):

After the completion of the course students will able to:

CO-1: Understand the mathematical description and representation of continuous-time and discrete-timesignals and systems.

CO-2: Also understand the concepts of various transform techniques.

CO-3: Apply sampling theorem to convert continuous-time signals to discrete-time signals.

CO-4: Reconstruct back, different transform techniques to solve signals and system related problems

CO-5: Analyze the frequency spectra of various continuous-time and discrete-time signals usingdifferent transform methods.

CO-6: Classify the systems based on their properties and determine the response of them.

DIGITAL LOGIC DESIGN					
Course Code	**L: T:P**	**Credits**	**Exam.Marks**	**Exam Duration**	**Course Type**
22A0405T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To understand the Arithmetic, binary codes and theory of Boolean algebra.
- To study representation of switching functions using Boolean algebra expressions andtheir minimization techniques.
- To study the combinational logic design of various logic circuits.
- To study the sequential logic circuits design both in synchronous and Asynchronousmodes.
- To be able to understand Logic and switching devices, their minimization techniques and their realizations.
- To study some of the programmable logic devices and their use in realization of switching functions.

Syllabus

Unit –I	**10 Hrs**

Basic Concepts: Code Conversions, Arithmetic operations, subtraction using 1's and 2's compliment, Binary coded decimal, Excess-3 Codes, Gray Codes, Binary weighted code, Alphanumeric codes, Problem Solving.

Unit –II	**10 Hrs**

Boolean Algebra: Introduction to Boolean Algebra – Axioms and Laws of Boolean Algebra – Boolean functions – Canonical and Standard Forms. Gate – Level Minimization: Introduction – Two, Three, Four Variable K-map's – Don't Care Conditions – NAND and NOR implementation, Problem Solving.

Unit –III	**10 Hrs**

Combinational circuits: Half/Full Adder and Subtractor, Ripple carry adder, Carry look ahead adder, Binary Adder/Subtractor, BCD adder, Binary Multiplier, Magnitude comparator, Multiplexers, De-Multiplexers, Decoders, Encoders. Problem solving.

Unit –IV	**9 Hrs**

Sequential circuits: Flip Flop-SR, JK, T, D, Master/Slave Flip Flop, Analysis and design of clocked sequential circuits-Design-Moore/Mealy models, State minimization, State assignment, Circuit Implementation-Counters, ripple Counters, Shift Registers, Problem solving.

Unit –V	**9 Hrs**

Logic families and Programmable Logic Devices: MOS, CMOS, BiCMOS, Comparisonof logic families, implementation of combinational and logic design using standard ICs, ROM, PLA and PAL, CPLDs and Problem solving.

Text Books:

1. M. Ciletti, "Digital Morris Mano and Michael D. Design – Pearson, 5th Edition, 2013.
2. Charles H. Roth, Jr, "Fundamentals of Logic Design", Jaico Books, 4th Edition, 2002.

References:

1. William I. Fletcher, “An Engineering Approach to Digital Design”, Prentice- Hall of India, 1980.
2. Floyd T.L., “Digital Fundamentals”, Charles E. Merril publishing company, 1982.
3. John. F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, 4th Edition, 2007.
4. E-learning resources: http://nptel.ac.in/courses.php

Course Outcomes:

After the completion of the course students will able to:

CO-1: Understand various types of Code conversions.

CO-2: Apply the Boolean theorems to Simplify Complex Boolean Function through logical gates.

CO-3: Design and implement various logical devices using combinational circuits.

CO-4: Design and implement various logical devices using sequential circuits.

CO-5: Analyze sequential circuits like Registers and Counters using flip-flops.

CO-6: Demonstrate and compare the construction of programmable logic devices and different types of ROM.

UNIVERSAL HUMAN VALUES
(Common to all branches of Engineering)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0021T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Syllabus		Total Hours:48
Unit -I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**10 Hrs**

Purpose and motivation for the course, recapitulation from Universal Human Values-I
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment ofaspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
Method to fulfill the above human aspirations: understanding and living in harmony at various levels.
Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit -II	**Understanding Harmony in the Human Being - Harmony in Myself!**	**9 Hrs**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Health.
Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease

Unit -III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**10 Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the

foundational values of relationship
Understanding the meaning of Trust; Difference between intention and competence
Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.
Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Unit -IV	**Understand the Nature and Existence hole existence as Coexis**	**9 Hrs**

Understanding the harmony in the Nature
Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
Holistic perception of harmony at all levels of existence.
Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can beused), pollution, depletion of resources and role of technology etc.

Unit -V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**10 Hrs**

Natural acceptance of human values
Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco- friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systemsStrategy for transition from the present state to Universal Human Order:
a. At the level of individual: as socially and ecologically responsible engineers, technologists andmanagers
b. At the level of society: as mutually enriching institutions and organizationsSum up.
Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. Todiscuss the conduct as an engineer or scientist etc.

Textbooks:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. 3. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.The Story of Stuff (Book).
3. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
4. E. FSchumacher. "Small is Beautiful"Slow is Beautiful –Cecile Andrews
5. J C Kumarappa "Economy of Permanence" Pandit Sunderlal "Bharat Mein Angreji Raj" Dharampal, "Rediscovering India"

6. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"India Wins Freedom - Maulana Abdul Kalam Azad Vivekananda - Romain Rolland(English)

Course Outcomes(CO):

On completion of this course, student will be able to:

CO-1: Students are expected to become more aware of themselves, and their surroundings (family, society, nature)

CO-2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO-3: They would have better critical ability.

CO-4: They would also become sensitive to their commitment towards what they have understood(human values, human relationship and human society).

CO-5: It is hoped that they would be able to apply what they have learnt to their own self in differentday-to-day settings in real life, at least a beginning would be made in this direction.

CO-6: Understand the harmony in the human being, family, society andnature/existence

ANALOG CIRCUITS					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0406T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To design amplifiers using BJT & MOSFETs at low and high frequencies.
- To understand the characteristics of Multistage amplifiers
- To understand the characteristics of Differential amplifiers, feedback and power amplifiers.
- To examine the response of tuned amplifiers and multivibrators
- To categorize different oscillator circuits based on the application
- To design the electronic circuits for the given specifications and for a given application.

Syllabus		**Total Hours:48**
Unit –I	**Multistage and Differential Amplifiers**	**10 Hrs**

Introduction to Multistage Amplifiers, different Coupling Schemes, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT DifferentialPair, and other Non-ideal Characteristics of the Differential Amplifier.

Unit –II	**Frequency Response**	**10 Hrs**

Low-Frequency Response of the CS and CE Amplifiers, Internal Capacitive Effects and the High-Frequency Model of the MOSFET and the BJT, High-Frequency Response of the CS and CE Amplifiers, High-Frequency Response of the CG and Cascode Amplifiers, High-Frequency Response of the Source and Emitter Followers.

Unit –III	**Feedback Amplifiers and Oscillators**	**10 Hrs**

Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies, The Feedback Voltage Amplifier (Series—Shunt), TheFeedback Trans-conductance Amplifier (Series—Series), The Feedback Trans-resistance Amplifier (Shunt—Shunt), The Feedback Current Amplifier (Shunt—Series), Summary.
Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.

Unit –IV	**Power Amplifiers**	**9 Hrs**

Introduction, Classification of Output Stages, Class A Output Stage, Class B Output Stage, Class ABOutput Stage, Biasing the Class AB Circuit, CMOS Class AB Output Stages, Class C power amplifier and Class S power amplifier, Power BJTs, Variations on the Class AB Configuration, MOS Power Transistors, Distortions in Amplifiers

Unit –V	**Tuned Amplifiers and Multi vibrators**	**9 Hrs**

Tuned Amplifiers: Basic Principle, Use of Transformers, Single Tuned Amplifiers, and Amplifiers with multiple Tuned Circuits, Stagger Tuned Amplifiers.
Multivibrators: Analysis and Design of Bistable, Monostable, and Astable Multivibrators.

Text Books:

1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. J. Millman, C Chalkias, "Integrated Electronics", 4thEdition, McGraw Hill Education (India) Private Ltd., 2015.
3. Millman and Taub, "Pulse, Digital and Switching Waveforms", 3rd Edition, Tata McGraw-Hill Education, 2011.

References:

1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010.
2. Donald A Neamen, "Electronic Circuits – Analysis and Design," 3rdEdition, McGraw Hill (India), 2019.
3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006.
4. K.Lal Kishore, "Electronic Circuit Analysis", 2ndEdition, B S Publications, 2008

Course Outcomes:

After the completion of the course students will able to:

CO-1: Describe the characteristics of Multistage and Differential amplifiers

CO-2: Analyze the frequency response of single stage amplifiers using BJT & FET at high and low frequencies

CO-3: Understand different feedback topologies and Oscillator circuits

CO-4: Analyze different types of large signal amplifiers

CO-5: Compare the performance of different tuned amplifiers and multivibrators

CO-6: Design of Tuned and Multivibrator for the given specifications

SIMULATION LAB					
Course Code	**L: T:P**	**Credits**	**Exam.Marks**	**Exam Duration**	**Course Type**
22A0407P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To realize the concepts studied in theory
- To simulate various Signals and Systems through MATLAB
- To apply the concepts of signals to determine their energy, power, psd etc.
- To analyze the output of a system when it is excited by different types of deterministic and random signals.
- To generate random signals for the given specifications

Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).
Note: All the experiments are to be simulated using MATLAB or equivalent software.

1. Write a program to generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse,Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Perform operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding,Computation of Energy and Average Power.
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal.
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences.
6. Write a program to find autocorrelation and cross correlation of given sequences.
7. Write a program to verify Linearity and Time Invariance properties of a givenContinuous/Discrete System.
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find magnitude and phase response of first order low pass and high pass filter.Plot the responses in logarithmic scale.
10. Write a program to find response of a low pass filter and high pass filter, when a speech signal ispassed through these filters.
11. Write a program to generate Complex Gaussian noise and find its mean, variance, ProbabilityDensity Function (PDF) and Power Spectral Density (PSD).
12. Generate a Random data (with bipolar) for a given data rate (say 10kbps).Plot the same for a timeperiod of 0.2 sec.

13. To plot pole-zero diagram in S-plane of given signal/sequence and verify its stability

References:

1. Stephen J. Chapman, "MATLAB Programming for Engineers", Cengage, November 2012.

Online Learning Resources/Virtual Labs: https://www.vlab.co.in/

Course Outcomes (CO):

After the completion of the course students will able to:

CO1: Learn how to use the MATLAB software and know syntax of MATLAB programming.

CO2: Understand how to simulate different types of signals and system response.

CO3: Find the Fourier Transform of a given signal and plot amplitude and phase characteristics.

CO4: Analyze the response of different systems when they are excited by different signals and plot power spectral density of signals.

CO5: Generate different random signals for the given specifications

CO6: Simulate different random signals for the given specifications

DIGITAL LOGIC DESIGN LAB					
Course Code	**L: T:P**	**Credits**	**Exam.Marks**	**Exam Duration**	**Course Type**
22A0408P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To construct digital circuit to examine Boolean algebra, truth table of different logic gates.
- To design various combinational and sequential circuits after analyzing their timing properties.
- To demonstrate digital circuits using Verilog and VHDL software.
- To Model the MOS, CMOS circuits using tools such as PSPICE/Multisim.

Syllabus

LIST OF EXPERIMENTS: (**Conduct any 12 experiments**)

Hardware:

1. Introduction to Digital Electronics Lab- Nomenclature of Digital Ics, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
2. Implementation of the Given Boolean Function using Logic Gates in Both Sop and PosForms.
3. Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
4. Implementation and Verification of Decoder and Encoder using Logic Gates.
5. Implementation of 8x1 multiplexer using Logic Gates.
6. Implementation of 4-Bit Parallel Adder Using 7483 IC.
7. Design, and Verify the 4- Bit Synchronous Counter/ Asynchronous Counter.

Software:

1. Simulation of MOS Inverter with different loads using PSPICE software
2. Simulation of CMOS Inverter for different parameters Kn, Kp as a design variable in suitable circuit simulator software.
3. Design of a 4-bit Multiplexer using VHDL\Verilog.
4. Design of a decade counter using VHDL\Verilog.
5. Design of a 3-input NAND gate and its simulation using suitable logic simulator.

Tools / Equipment Required:

- Analog - Digital & Digital-Analog ConverterFacility Available in the Laboratory:
- Power Supply (0 ---30V, +12 –0 -- -12v. +5volt).
- Multimeter (0 ---20M ohm, 0-1000 DC Volt, 0--700A.C volt, 20micro 10 Amp.)
- IC Tester (Digital and Linear)

Course Outcomes:

After the completion of the course students will able to:

CO1: Learn the basics operation of gates.

CO2: Construct basic combinational circuits and verify their functionalities**.**

CO3: Apply the design procedures to design basic sequential circuits.

CO4: Learn about counters.

CO5: Learn about Shift registers

CO6: Simulate basic digital circuits and to verify their operation in PSPICE /VHDL.

ANALOG CIRCUITS LAB

Course Code	L: T:P	Credits	Exam.Marks	Exam Duration	Course Type
22A0409P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To understand the characteristics of Differential amplifiers, feedback and power amplifiers.
- To examine the response of tuned amplifiers and multivibrators
- To categorize different oscillator circuits based on the application
- To design the electronic circuits for the given specifications and for a given application.

Syllabus

LIST OF EXPERIMENTS: (**Conduct any 10 experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Design and Analysis of Darlington pair.
2. Design and Analysis of Cascode Amplifier.
3. Frequency Response of Differential Amplifier
4. Design and Analysis of Series – Series feedback amplifier and find the frequency response of it.
5. Design and Analysis of Shunt – Shunt feedback amplifier and find the frequency response of it.
6. Design and Analysis of Class A power amplifier
7. Design and Analysis of RC phase shift oscillator
8. Design and Analysis of LC Oscillator
9. Frequency Response of Single Tuned amplifier
10. Design and Analysis of Bistable Multivibrator
11. Design and Analysis of Monostable Multivibrator
12. Design and Analysis of Astable Multivibrator

Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

Online learning resources/Virtual labs: https://www.vlab.co.in/

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand Characteristics and frequency response of various Multi stage amplifiers for Low, Mid and High frequencies.

CO2: Analyze Feedback amplifier for Specified gain.

CO3: Design various Oscillator Circuits.

CO4: Determine the efficiencies of Class A, B power amplifiers using BJT.

CO5: Analyze of Tuned Amplifiers.

CO6: Analyze of Multivibrators

PYTHON PROGRAMMING (Common to CS, DS, EEE,ME and ECE)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3205	**1:0:2**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**SC**

Course Objectives:

This course will enable students to:

- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming
- Develop the skill of designing graphical-user interfaces (GUI) in Python.
- Develop the ability to write database applications in Python.

Syllabus	**Total Hours:48**

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements

Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

1:OPERATORS

a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
b. Read your name and age and write a program to display the year in which you will turn 100 years old.
c. Read radius and height of a cone and write a program to find the volume of a cone.
d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2:CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.
b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while

loop.

c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input : n = 5, Output : 2.70833)
d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(„GFG“, „IS“, „BEST“)]).
c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
b. Write a program to perform union, intersection and difference using Set A and Set B.
c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input: S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

a. Write a program to do the following operations:
    i. Create a empty dictionary with dict() method
    ii. Add elements one at a time
    iii. Update existing key‟s value
    iv. Access an element using a key and also get() method
    v. Deleting a key value using del() method
b. Write a program to create a dictionary and apply the following methods:
    i. pop() method

ii. pop item() method
iii. clear() method

c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split () method, Input: India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
b. Write a function merge_dict (dict1, dict2) to merge two Python dictionaries.
c. Write a fact () function to compute the factorial of a given positive number.
d. Given a list of n elements, write a linear_search () function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean (), mode(), median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trigonometric functions sin (), cos(), tan(), hypot(), degrees(), radians() by importing math module.
c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

a. Write a program to create a Bank Account class. Your class should support the following methods for
   i) Deposit
   ii) Withdraw
   iii) Get Balance
   iv) Pin Change
b. Create a Savings Account class that behaves just like a Bank Account, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info()

method and also using dictionary (_dict_).

d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

a. Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
   i. Count the sentences in the file.
   ii. Count the words in the file.
   iii. Count the characters in the file.

b. Create a new file (Hello.txt) and copy the text to another file called target.txt. The target.txt file should store only lower-case alphabets and display the number of lines copied.

c. Write a Python program to store N student's records containing name, roll number and branch. Print the given branch student's details only.

Text Book:

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.

Reference Books:

1. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
2. Michael H Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
3. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python", BPB publication, 1st Edition, 2019.
4. Ashok Kamthane, Amit Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
5. Taneja Sheetal, Kumar Naveen, "Python Programming – A modular approach", Pearson, 2017

Web References:

1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming/
5. https://www.geeksforgeeks.org/python-programming-language/

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Understand various data types like lists, tuples, strings etc.

CO2: Able to create practical and contemporary applications using Functions

CO3: Explore the use of Object oriented concepts to solve Real-life problems

CO4: Explore the use of Object-oriented concepts to solve Real-life problems

CO5: Utilize Python packages in developing software applications

CO6: Solve mathematical problems using Python programming language

CONSTITUTION OF INDIA

(Common to all branches of Engineering)

Course Code	L: T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0029M	**3:0:0:0**	**-**			

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court andhigh courtcontroller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

Syllabus		**Total Hours:48**
Unit I	**Introduction to Indian Constitution**	**10 Hrs**
Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution Sourcesand constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.		
Unit -II	**Union Government and its Administration Structure of the Indian Union**	**9 Hrs**
Union Government and its Administration Structure of the Indian Union - Federalism – Centre State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions		
Unit -III	**State Government and its Administration**	**10 Hrs**
State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions.		
Unit -IV	**Local Administration**	**10 Hrs**
Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy		
Unit -V	**Election Commission**	**9 Hrs**
Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women		

Textbooks:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. NewDelhi
2. Subash Kashyap, "Indian Constitution", National Book Trust 3. R R Gaur, R Asthana,

Reference Books:

1. H.M.Sreevai, "Constitutional Law of India", 4th edition in 3 volumes
2. J.A. Siwach, "Dynamics of Indian Government & Politics"
3. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in Constitutional Law, Prentice - Hall of India Pvt. Ltd. New Delhi
4. J.C. Johri, Indian Government and Politics Hans
5. M.V. Pylee, "Indian Constitution)

E-Resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/10910404
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture- details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights for becoming good citizen of India.

CO4: Understand the value of the fundamental duties for becoming good citizen of India.

CO5: Analyze the decentralization of power between central, state and local self-government

CO6: Apply the knowledge in strengthening of the constitutional institutions like CAG,Election Commission and UPSC for sustaining democracy

Semester - 4 (Theory-6, Lab-3, MC-1)							
Sl. No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	HSC	22A0022T	Managerial Economics & Financial Analysis	3	0	0	3
2	ESC	22A0205T	Electrical Engineering	3	0	0	3
3	PCC	22A0414T	Electromagnetic Waves and Transmission Lines	3	0	0	3
4	PCC	22A0415T	Analog & Digital Communications	3	0	0	3
5	PCC	22A0416T	Linear IC Applications	3	0	0	3
6	PCC (Lab)	22A0417T	Linear IC Applications Lab	0	0	3	1.5
7	ESC (Lab)	22A0206P	Electrical Engineering Lab	0	0	3	1.5
8	PCC (Lab)	22A0418P	Analog & Digital Communications Lab	0	0	3	1.5
9	SC	22A0419P	**Skill Oriented Course:** PCB & Circuit Designing	1	0	2	2
10	MC	22A0027M	**Mandatory Course:** Environmental Studies	2	0	0	0
						Total credits	**21.5**
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

Category	Credits
Humanities and Social Science Course (HSC)	3
Engineering Science Course (ESC)	4.5
Professional Core Courses (PCC)	12
Skill oriented Course (SC)	2
Total	21.5

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					
Course Code	**L: T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0022T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To understand the concepts of managerial economics and financial analysis this helps inoptimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with theproduction and factors of production.
- To have a thorough knowledge regarding market structure and forms of businessorganizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions inpreparing of final accounts.

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Managerial Economics & Demand**	**9 Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticityof Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and
Management.

Unit -II	**Theory of Production and Cost Analysis**	**9 Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Iso costs, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Unit -III	**Introduction to Markets and Forms of Business Organiza**	**10 Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-.

Unit -IV	**Capital and Capital Budgeting**	**10 Hrs**

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value(NPV) – Internal Rate Return (IRR) Method (simple problems)

Unit -V	Introduction To FinancialAccounting And Analysis	10 Hrs

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Managerial Economics, PL Mehata, Sulthan Chand Publications
2. Aryasri: "Business Economics and Financial Analysis", 4th edition, MGH, 2019

Reference Books:

1. Ahuja Hl "Managerial economics" 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: "Managerial Economics and Financial Analysis", New Age International, 2013.
3. Joseph G. Nellis and David Parker: "Principles of Business Economics", 2nd edition, Pearson, New Delhi.
4. Domnick Salvatore: "Managerial Economics in a Global Economy", Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.

CO2: Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis.

CO3: Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange.

CO4: Interpret various techniques for assessing the proposals of project for financial position of the business.

CO5: Evaluate the capital budgeting techniques

CO6: Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts.

ELECTRICAL ENGINEERING					
Course Code	**L: T:P:C**	**Credits**	**ExamMarks**	**Exam Duration**	**Course Type**
22A0205T	**3: 0:0:0**	**3**	**CIE: 30** **SEE:70**	**3Hours**	**ESC**

Course Objectives:

Student will be able to:

- Distinguish between classical method and Laplace transform approach in analyzing transient phenomenon in DC excitations
- Understand and design the different types of filters.
- To know about various characteristics of DC Generators and motors.
- To know about principle of operation of a DC machine working as a generator and motor.
- To understand computation and predetermination of regulation of a 1-ϕ transformer
- To know about principle of operation of three phase induction motor.

UNIT- I	**Transient Analysis**	**10Hrs**

Introduction, Source free R-L, R-C circuits, R-L, R-C circuits with DC, step, pulse forcing functions, Source free R-L-C circuits – under damped, over damped and critical damped cases, Response of RL-Ccircuits with DC and Sinusoidal forcing functions, Relationship between bandwidth and Quality factor in R-L-C circuits – Response of R-L-C circuits using Integral-differential equation and Laplace Transform approaches for dc And – Problem Solving.

UNIT-II	**Frequency Response**	**9Hrs**

Introduction, Series and Parallel Resonant circuits, Resonant frequency, Relationship between bandwidth and Quality factor, Variation of resonant frequency with circuit elements, Passive Filters – Low pass, High pass, band pass, band elimination filter, – Problem Solving-3 Phase circuits.

UNIT-III	**Two-port Networks**	**10Hrs**

Introduction, Types of two port networks, Various parameters of two port networks, Impedance, Admittance, Transmission, Hybrid parameters and their relations – Finding the two port parameters for various circuits, Concept of transformed network, conversion from one parameter to other parameters– Problem solving.

UNIT-IV	**DC Machines**	**10Hrs**

DC Generators: Principle of operation of DC machines – EMF equation – types of generators – applications of dc generators Magnetization and Load characteristics of DC generators

DC Motors: Principle of operation of DC Motor, Types of Motors, Back EMF Equation, Characteristics of DC motor, Torque Equation, Three Point starter, Efficiency Calculation, and speed control.

UNIT-V	**AC Machines**	**9Hrs**

Transformers: Construction and principle of operation of single-phase transformer –EMF equation O.C & S.C. tests – efficiency Induction Motors: Principle and operation of three phase induction motors – Constructional details – Torque equation- slip torque characteristics and power flow equations of –phase IM

Alternators: Principle and operation of alternators – EMF equation – parallel operation of alternators.

Textbooks:

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, "Engineering Circuit Analysis",Mc Graw Hill,9th edition, 2019.
2. Charles Alexander & Mathew Sadiku, "Fundamentals of Electric Circuits", 6th edition,McGraw HillPublications, 2016.
3. I. J. Nagrath&D.P.Kothari, "Electric Machines", 7th Edition, Tata Mc Graw Hill, 2005.

Reference Books:

1. M.E. Van Valkenberg, "Network Analysis", 3rd Edition, Prentice Hall (India), 1980.
2. B. R. Gupta, "Fundamentals of Electric Machines", Vandana Singhal, 3rd Edition, New ageInternational Publishers, 2005.
3. T.K. Nagsarkar and M.S. Sukhija, "Basic Electrical Engineering", 3rd Edition, Oxford University Press2017.
4. S. Kamakashiah, "Electromachanics – III", overseas publishers Pvt. Ltd.
5. V.K. Mehta an2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBSPublishers, 2004.
6. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc21_ee71/preview

https://onlinecourses.nptel.ac.in/noc21_ee24/preview

Course Outcomes (CO):

After the completion of the course students will be:

CO1: Able to acquire knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.

CO2: Able to solve the problems on R L C circuits for different excitations using different approaches.

CO3: Analyze the complex circuits of R L C circuits

CO4: Able to solve the problems the e.m.f. generated on DC Generator.

CO5: Design winding diagrams of AC machines and equivalent circuit of transformer.

CO6: Able to acquire knowledge about how to determine the efficiency and regulation of single phase transformer and synchronous machine.

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Course Code	L: T:P	Credits	Exam.Marks	Exam Duration	Course Type
22A0414T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce fundamentals of static and dynamic electromagnetic fields.
- To teach the application of vector calculus for problem solving in Electromagnetic fields.
- To introduce Maxwell's equations in wave concept.
- To introduce the propagation of electromagnetic waves intransmission lines and their practical applications.
- To analyze the behaviour of electromagnetic waves propagated in normal andoblique incidences.

Syllabus

Unit –I **Static Electric Fields** **10 Hrs**

Recap of Vector Analysis: Coordinate systems and transformation-Cartesian, Cylindrical and Spherical coordinate

Recap of Vector Calculus: Differential length area and volume, line surface and volume integrals, Del operator, gradient, divergent and curl operations.

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Divergence Theorem, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

Unit –II **Static Magnetic Fields & Time varying Fields** **10 Hrs**

Magnetic Fields: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic dipole, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's equations for time varying fields, Maxwell's Equations in Different Final Forms and Word Statements, Illustrative Problems

Unit –III **Boundary Conditions and Uniform Plane Wave** **10 Hrs**

Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Wave Equations for Conducting and Perfect Dielectric Media.

Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems

Unit –IV **Reflection and Refraction of Plane Waves** **9 Hrs**

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Poynting Vector, and Poynting Theorem, Illustrative Problems.

Unit –V	Transmission Lines	9 Hrs

Transmission Lines: Introduction, Transmission line parameters, Transmission line equivalent circuit, Transmission line equations and their solutions in their phasor form, input impedance, standing wave ratio, Transmission of finite length- half wave, quarter wave transmission line, Smith chart, graphical analysis of transmission lines using Smith chart, stub matching- single and double stub matching, Illustrative Problems

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 4th edition. Oxford Univ. Press,2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 7thedition.,TMH,2006.

References:

1. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2ndEdition, PHI, 2000.
2. John D. Krauss, "Electromagnetics", 4th Edition, McGraw- Hill publication, 1999.
3. Electromagnetics, Schaum's outline series, 2nd Edition, Tata McGraw-Hill publications,2006.

Course Outcomes:

After the completion of the course students will able to:

CO1: Describe vector algebra, coordinate systems, vector calculus and fundamentals of electrostatic fields' duo to point, line, sheet, and volume charges using Coulomb's law and Gauss's law.

CO2: Calculate magnetic field intensity using Biot-Savart's law and Ampere's law

CO3: Analyze Maxwell's equations for Time-varying EM fields.

CO4: Analyze boundary conditions of EM fields for dielectric-dielectric, dielectric-conductor media.

CO5: Describe the propagation of UPW in good conductor, good dielectric, Dielectric-Dielectric, Dielectric-Conductor media.

CO6: Analyze the concept of transmission lines and their applications.

ANALOG & DIGITAL COMMUNICATIONS					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0415T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- Able to compute the bandwidth and transmission power by analyzing time and frequency domain spectra of signal required under various modulation schemes.
- Able to apply suitable modulation schemes various applications.
- Able to analyze analog modulation techniques by using signal processing tools. To introduce the different digital modulation techniques such as PCM, DM and various shift keying techniques, information theory and different source coding techniques.
- To introduce different error detecting and error correcting codes like block codes, cyclic codes and convolution codes.

Syllabus

Unit –I	**10 Hrs**

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, Costas Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

Unit –II	**10 Hrs**

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM, Super heterodyne receiver.Application of SIMTEL Analog Communication Tool.

Introduction to Noise: Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers, Pre-Emphasis and De-emphasis in FM.

Unit –III	**10 Hrs**

Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

Baseband Pulse Transmission: Introduction, Matched Filter, Properties of Matched Filter, Error rate due to noise, Inter Symbol Interference (ISI), Nyquist criterion for distortion less baseband binary transmission, Correlative level coding, Baseband M-ary PAM transmission, QAM, Equalization, Eye pattern.

Unit –IV	**9 Hrs**

Digital Pass band Transmission: Introduction, Pass band Transmission Model, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of bank of correlators in noise, Correlation receiver, Probability of Error, Detection of Signals with unknown phase.

Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, and DPSK.M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Timing and Frequency Synchronization.

Unit –V	9 Hrs

Channel Coding: Error Detection & Correction - Repetition & Parity Check Codes, Interleaving, Code Vectors and Hamming Distance, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolutional Codes – Convolutional Encoding, Decoding Methods.

Text Books:

1. Simon Haykin, "Communication Systems", John Wiley& Sons, 4th Edition, 2004.
2. B. P. Lathi, Zhi Ding "Modern Digital and Analog Communication Systems", Oxford press,2011.

References:

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley& Sons, 1999.
2. Bernard Sklar, F. J. Harris, "Digital Communications: Fundamentals and Applications", Pearson Publications, 2020.
3. Taub and Schilling, "Principles of Communication Systems", Tata McGraw Hill, 2007.

Course Outcomes:

After the completion of the course students will able to:

CO1: Recognize the basic terminology used in analog and digital communication techniques for transmission of information/data.

CO2: Explain the basic operation of different analog and digital communication systems at baseband and pass band level.

CO3: Compute various parameters of baseband and pass band transmission schemes by applying basic engineering knowledge.

CO4: Analyze the performance of different modulation & demodulation techniques to solve complex problems in the presence of noise.

CO5: Evaluate the performance of all analog and digital modulation techniques to know the merits and demerits of each one of them in terms of bandwidth and power efficiency.

CO6: Understand the basics of information theory and error correcting codes.

LINEAR IC APPLICATIONS

Course Code	L: T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0416T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To teach the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits.

Syllabus

Unit –I	10 Hrs

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, and Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparator and its applications, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

Unit –II	10 Hrs

OP-AMP, IC-555 & IC 565 Applications: Introduction To Active Filters, Characteristics of Band Pass, Band Reject And All Pass Filters, Analysis Of 1st Order LPF& HPF Butterworth Filters, Waveform Generators - Triangular, Saw-Tooth, Square Wave, IC555 Timer - Functional Diagram, Monostable And Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

Unit –III	10 Hrs

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel ComparatorType ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

Unit –IV	9 Hrs

Digital Integrated Circuits: Classification of Integrated Circuits, Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoder, Encoder, Priority Encoder, Multiplexer, De-multiplexer, Parallel Binary Adder/ Subtractor, Magnitude Comparator.

Unit –V	9 Hrs

Sequential Logic Ic's and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, conversion of Flip-flops, Synchronous Counter, Decade Counter, Shift Register. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Text Books:

1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2ndEdition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 2003.
3. Digital fundamentals – Floyd and Jain, Pearson Education,8th Edition ,2005.

References:

1. Op Amps & Linear Integrated circuits-Concepts and Applications James M.Fiore,Cengage Learning/Jaico,2009.
2. Operational Amplifiers with linear integrated circuits by K.Lal kishore-Pearson,2009.
3. Linear integrated circuits and applications-Salivahana,TMH.
4. Modern digital electronics-RP Jain-4/e-TMH,2010.
5. Digital design principles and practices-John.F.Wakerly 3/e,2005.

Course Outcomes:

After the completion of the course students will able to:

CO1: List out the characteristics of Linear and Digital ICs.

CO2: Discuss the various applications of linear & Digital ICs.

CO3: Solve the application-based problems related to linear and digital ICs.

CO4: Analyze various applications-based circuits of linear and digital ICs.

CO5: Design the circuits using either linear ICs or Digital ICs from the given specifications.

CO6: Understand the various type of Memory Architectures using the Digital ICs.

LINEAR IC APPLICATIONS LAB

Course Code	L: T:P	Credits	Exam.Marks	Exam Duration	Course Type
22A0417T	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of Diodes, BJT, MOSFET.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

Syllabus

MINIMUM TWELVE EXPERIMENTS MUST CONDUCT: (Six from each part A & B)

PART -A:

TO VERIFY THE FOLLOWING FUNCTIONS

1. Adder, Subtractor, Comparator Circuits using IC 741 OP AMP.
2. Integrator and Differentiator Circuits using IC 741 OP AMP.
3. Active Low pass, High pass Butterworth (Second Order).
4. RC Phase Shift and Wien Bridge Oscillators using IC 741 Op-Amp.
5. IC 555 Timers – Monostable Operation Circuits.
6. Schmitt Trigger Circuits – using IC 741 and IC 555.
7. IC 565 –PLL applications
8. Voltage Regulator using IC 723, Three terminal voltage regulators 7805,7809, 7912
9. Sample and Hold LF398 IC

PART –B:

TO VERIFY THE FOLLOWING FUNCTIONALITY OF THE FOLLOWING 74 SERIES TTL ICS

1. D-Flip Flop (74LS74) and JK Master Slave Flip-flop(74LS73)
2. Decade counter (74LS90) and Up-down Counter (74LS192)
3. Universal shift Register(74LS194/195)
4. 3-8 Decoder using (74LS138).
5. 4 – bit comparator (74LS85)
6. 8x1 Multiplexer - 74LS151 and 2x4 DeMultiplexer-74155.
7. RAM 16X4 -74189(read and write operation)
8. Stack and queue implementation using RAM, 74189

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. Bread Boards
6. Components: - IC741, IC555, IC566, IC1496, IC723, 7805, 7809, 7912 and other Essential components.
7. Analog IC Tester

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the characteristics of Linear and Digital ICs.

CO2: Design circuits using operational amplifiers for various applications

CO3: Analyze various applications-based circuits of linear and digital ICs

CO4: Design various combinational circuits using various Digital Integrated IC's.

CO5: Design various Sequential Logic circuits and Memories circuits using various DigitalIntegrated IC's.

CO6: Understand differences between Linear and Digital Integrated IC's.

ELECTRICAL ENGINEERING LAB					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0206P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**ESC**

Course Objectives:

- Apply and experimentally analyze two port network parameters
- To do experiments on DC Machines
- To do experiments on AC Machines

LIST OF EXPERIMENTS

1. Response of RL and RC circuits for pulse inputs.
2. Determination of Z & Y parameters for the given two port network.
3. Determination of Transmission and Hybrid Parameters of a given two port networks
4. OCC of DC Shunt generator.
5. Load characteristics of DC shunt generator.
6. Load characteristics of DC series generator.
7. Load characteristics of DC shunt motor
8. Swinburne's test.
9. Speed control of DC shunt motor.
10. OC & SC tests on a 1-φ transformer.
11. Load test on Squirrel cage Induction motor.
12. Predetermination of regulation of alternator by Synchronous impedance method.Note: Student has to perform at least 10 experiments.

Reference Books:

1. D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand & Bros

Web References:

1. Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of EEE http://vem-iitg.vlabs.ac.in/
2. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
3. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

Course Outcomes (CO):

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

CO1: Determine the various parameters experimentally

CO2: Understand various characteristics of DC generators.

CO3: Understand various characteristics of DC motors.

CO4: Predetermine the efficiency and regulation of a 1-φ transformer.

CO5: Predetermine the efficiency and regulation of an Alternator.

CO6: Determine the efficiency of a Squirrel cage Induction motor.

ANALOG & DIGITAL COMMUNICATIONS LAB					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0418P	**0:0:3**	**1.5**	**CIE:30** **SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To understand the basics of analog and digital modulation techniques.
- To design and implement different modulation and demodulation techniques and their applications.
- To analyze the Pulse modulation techniques.

Syllabus

LIST OF EXPERIMENTS:

Note: Conduct any six experiments from each section.

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. FM Modulation and Demodulation
4. Radio receiver measurements
5. PAM Modulation and Demodulation
6. PWM Modulation and Demodulation
7. PPM Modulation and Demodulation

Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BFSK Modulation and Demodulation
6. QPSK Modulation and Demodulation
7. DPSK Modulation and Demodulation

Tools / Equipment Required:

1. CROs: 20MHz
2. Function Generators: 2MHz
3. Spectrum Analyzer
4. Regulated Power Supplies: 0-30V
5. Analog and Digital Modulation and Demodulation Trainer Kits.

Course Outcomes:

After the completion of the course students will able to:

CO1: Know about the usage of equipment/components/software tools used to conduct the experimentsin analog and digital modulation techniques.

CO2: Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally.

CO3: Analyze the performance of a given modulation scheme to find the important metrics of thesystem theoretically.

CO4: Draw the relevant graphs between important metrics of the system from the observedmeasurements.

CO5: Compare the experimental results with that of theoretical ones and infer the conclusions.

CO6: Design and implement different modulation and demodulation techniques.

PCB & CIRCUIT DESIGNING					
Course Code	**L: T:P**	**Credits**	**Exam.Marks**	**Exam Duration**	**Course Type**
22A0419P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**SC**

Course Objectives:

- This course will teach how to design and fabricate PCB for prototyping as well as in Industrial Production environment.
- This will help students to innovate faster with electronics technology.

Syllabus	**Total Hours: 48**

UNIT I

Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, creating new PCB, browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT II

Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation(EDA)tools and comparison.

UNIT III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards.

Practice Exercises: Any twelve experiments are to be done

1. Practice following PCB Design steps
   - Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Net list generation.
   - Layout Design: Familiarization of Foot print Editor, Mapping of components, Creation of PCB layout Schematic.
   - Create new schematic components.
   - Create new component footprints.
2. Regulator circuit using 7805
3. Inverting Amplifier or Summing Amplifier using op-amp
4. Full-wave Rectifier
5. Astable multivibrator and Monostable multivibrator using IC555
6. Calling bell circuit and Temperature measuring circuit.
7. Automatic street light using LDR sensor.
8. LED Chaser using 4017B decoded counter and IC555.
9. Water level indicator using IC555.
10. Sequenced display of traffic lights using IC555 and IC74LS190.
11. Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor,headers, LED.

12. Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector, Jumper, LEDs
13. Design an 8051 Development board having Reset & Input/output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors.
14. Fabricate a single-sided PCB, mount the components, and assemble them in a cabinet for any one of the circuits mentioned in the above exercises.

Text Book:

1. Printed circuit board design ,fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006

References:

1. Printed circuit Board Design and technology, Walter C. Bosshart
2. Printed Circuits Handbook, Sixth Edition,by Clyde F. Coombs, Jr, Happy T. Holden,Publisher: McGraw-Hill Education Year: 2016

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand a single layer PCB
CO2: Understand a multilayer PCB
CO3: Apply PCB for various applications.
CO4: Design PCB for 8051
CO5: Create and fabricate a PCB
CO6: Evaluate and test a PCB

ENVIRONMENTAL STUDIES
(Common to CSE, AI&ML, ECE, EEE, ME)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0027M	3: 0:0:0	0		3 Hours	MC

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations andpollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

	Syllabus	Total Hours: 48 Hrs
Unit- I	**Multidisciplinary Nature of Environmental Studies and Natural Resources**	**10Hrs**

Definitions, components of Environment, Scope and Importance –Need for Public Awareness

Renewable and non-renewable resources –Forest resources – Use and over – exploitation, deforestation,

– Food resources: World food problems, changes caused by agriculture and overgrazing, effects ofmodern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Unit-II	**Ecosystems**	**9Hrs**

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers– Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem

a. Grassland ecosystem.
b. Desert ecosystem

Unit-III	**Biodiversity And Its Conservation**	**10Hrs**

Introduction Definition: genetic, species and ecosystem diversity – Value of biodiversity consumptive use, Productive use, social, ethical, aesthetic and option values — India as a mega diversity nation – Hot spots of biodiversity – Threats to biodiversity: habitat loss, poaching Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-IV	**Environmental Pollution**	**9Hrs**

Definition, Cause, effects and control measures of:

a. air pollution
b. water pollution
c. noise pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes

Unit-V	Social Issues and The Environment	10Hrs

From Unsustainable to Sustainable development – Urban problems related to energy Environment Protection Act. – Air (Prevention and Control of Pollution) act

Definition, Cause, effects and control measures of:

a. Global warming
b. Acid rain
c. Ozone layer depletion

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain –Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses- Erach Bharucha forUniversity Grants Commission, Universities Press.
2. Environmental Studies- Kaushik & kaushik, New Age Pubilishers.

Reference Books:

1. Environmental studies- R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies- J.P.Sharma, Laxmi publications.

Course Outcomes (CO):

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

CO1: Recognize the knowledge about environment, natural resources and different techniques involved in its conservation.

CO2: Describe the information about different eco-systems and its functions.

CO3: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO4: Explain the different types of bio-diversity along with values and conservation methods.

CO5: Predict various environmental pollutions and able to design the environmentally friendly process inengineering.

CO6: Apply the sustainable development concepts in life, society and industry.

Semester - 5 (Theory-6, Lab-2, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A0420T	Digital System Design through Verilog	3	0	0	3
2	PCC	22A0213T	Control Systems	3	0	0	3
3	PCC	22A0421T	Antennas & MicrowaveEngineering	3	0	0	3
4	PEC		**Professional Elective-I**	3	0	0	3
5	OEC		**Open Elective-I**	3	0	0	3
6	PCC (Lab)	22A0425P	Digital System Design throughVerilog Lab	0	0	3	1.5
7	PCC (Lab)	22A0426P	Antennas & MicrowaveEngineering Lab	0	0	3	1.5
8	SC	22A0028P	**Skill Advanced Course:** Soft Skills	1	0	2	2
9	MC	22A0526	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
		22A0459	Evaluation of Community Service Project	0	0	0	1.5
						Total credits	**21.5**

S. No.	Course Code	Name of the Professional Elective-I
1	22A0422T	Data Communication &Networks
2	22A0423T	Information Theory and Coding
3	22A0424T	Industrial Electronics

S. No.	Course Code	Name of the Open Elective-I
1	22A0512T	Data base Management Systems
2	22A0214Ta	Power Electronics
3	22A0332Tc	Fundamentals of Drone Technology
4	22A0149T	Building Materials

Category	Credits
Professional Core Courses (PCC)	12
Professional Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Advanced Course (SC)	2
Summer Internship	1.5
Total	21.5

DIGITAL SYSTEM DESIGN THROUGH VERILOG					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0420T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To designing digital circuits, behaviour and RTL modeling of digital circuits using Verilog HDL
- To verifying these Models and synthesizing RTL models to standard cell libraries and FPGAs.
- The Students aims to practical experience by designing, modelling, implementing and verifying several digital circuits.
- To provide students with the understanding of the different technologies related to HDLs, construct, compile and execute Verilog HDL programs using provided

Syllabus	Total Hours: 48
Unit –I::Introduction and Basics of Verilog HDL	**10 Hrs**

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description,Behavioural description of Verilog, Concurrency,Simulation and Synthesis, Programming Language Interface, Module.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Scalars and Vectors, Operators.

Unit –II:: Gate Level Modeling and Data flow	**10 Hrs**

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Gate Delay, Strengths and Contention Resolution, Net Types.

Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

Unit –III:: Behavioral Modeling	**10 Hrs**

Behavioral Modeling: Introduction, Operations and Assignments, 'Initial' Construct, Always construct, Assignments with Delays, 'Wait ‘Construct, Design at Behavioral Level, Blocking and Non Blocking Assignments, The 'Case' Statement, 'If' and 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, sequential and Parallel Blocks.

Unit –IV:: Switch Level Modeling	**9 Hrs**

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, instantiation with strengths and delays, Switch level modeling for NAND, NOR and XOR.

Unit –V:: System Tasks, Functions & Compiler Directives & Sequential Circuit Description	**9 Hrs**

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, User Defined Primitives, Compiler directives.

Sequential Circuit Description: Sequential Models - Feedback Model, Capacitive Model, Implicit Model.

Text Books:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design through Verilog HDL, Wiley 2009.
2. 2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.

References:

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown,Zvonkoc Vranesic, TMH, 2nd Edition.
2. Zainalabdien Navabi, Verliog Digital System Design, TMH, 2nd Edition.
3. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.
4. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.

Course Outcomes:

After the completion of the course students will able to:

CO1: Describe Verilog HDL Design Digital circuits

CO2: Write behavior model of digital circuits

CO3: Write RTL models of digital circuits

CO4: Describe standard Cell Libraries and FPGAs

CO5: Synthesize RTL models to standard cell libraries and FPGAs

CO6: Implement RTL models on FPGAs and testing and verification

CONTROL SYSTEMS ENGINEERING

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0213T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

Unit-I	Concept of Control System	10 Hrs

Classification of control systems - Open loop and closed loop control systems, Differences, Examples of control systems- Effects of feedback, Feedback Characteristics. Mathematical models Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

Transfer Function Representation: Block diagram algebra, Determining the Transfer function from Block Diagrams, Signal flow graphs(SFG) - Reduction using Mason's gain formula Transfer function of SFG's.

Unit –II	Time Response Analysis	10 Hrs

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

Unit –III	Stability Analysis in Time Domain	10 Hrs

A) Stability Analysis in S-Domain: The concept of stability – Routh-Hurwitz's stability criterion – qualitative stability and conditional stability – Limitations of Routh-Hurwitz's stability

B) **Root Locus Technique:** Concept of root locus - Construction of root locus, Effects of addin g and zeros to G(s) H(s) on the root loci.

Unit –IV	Frequency Response Analysis	9 Hrs

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.
Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

Unit-V	State Space Analysis of Continuous Systems	9 Hrs

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Text Books:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

References:

1. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the concepts of control systems feedback effect, mathematical modelling, and time response.

CO2: Apply the concepts of Block diagram reduction, Signal flow graph method for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations.

CO3: Apply the concept of controllability and observability and demonstrate the use of these techniques.

CO4: Analyze time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.

CO5: Design and develop different compensators, controllers and their performance evaluation for various conditions.

CO6: Implement different compensators and controllers in solving various engineering applications.

ANTENNAS & MICROWAVE ENGINEERING					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0421T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To allow the student to understand the basic principles in antenna and micro wave system design.
- To make the student to gain knowledge in various antenna designs.
- To enable the student knowledge in the area of microwave components and antenna for practical applications.

Syllabus	**Total Hours: 48**
Unit –I	**10 Hrs**

Introduction to Antennas: Definition of antenna,Smart reconfigurable and frequency independent antennas, Radiation Mechanism – single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole– Current Distributions, Field Components, Radiated power, Radiation Resistance, Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and
short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment)

Unit –II	**10 Hrs**

VHF, UHF and Micro wave Antennas: Helical Antennas-Helical Geometry, Helix modes, Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas-Geometry and parameters, characteristics of Micro strip antennas, parabola reflectors-geometry, pattern characteristics, Feed Methods, Reflector Types - Related Features.

Unit –III	**10 Hrs**

Antenna Arrays and propagation: Arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, Arrays with Parasitic Elements-Yagi- Uda Arrays, Folded Dipoles & their characteristics Ground wave propagation Space wave propagation-Sky wave propagation(Qualitative treatment).

Waveguides: Introduction,Wave Guide theory, Rectangular wave guides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Wave guide current and mode
excitation.

Unit –IV	**9 Hrs**

Microwave Components: Introduction to scattering parameters and their properties, Hybrid Tees (H-plane, E-plane, Magic Tees), Hybrid ring, Directional Couplers – Bethe hole and Two-hole Couplers, Deriving Scattering matrix for H-plane, E-plane, Magic Tees.

Micro wave Amplifiers and Oscillators: Micro wave Tubes: Linear Beam Tubes–Two cavity Klystron amplifier -velocity modulation, bunching process, Reflex Klystron oscillator, Travelling Wave Tube (TWT) – Bunching process and amplification process (Qualitative treatment only). Crossed Field Tubes–Magnetron oscillator, pi-mode operation, Hartree Condition.

Unit –V	9 Hrs

Micro wave Semi conductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model. Antennas and Microwave Measurements: Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods). Description of Microwave bench-different blocks and their features, errors and precautions, Measurement of attenuation, frequency, VSWR (low, medium, high), Impedance measurements.

Textbooks:

1. JohnD.Kraus, Ronald J. Marhefkaand Ahmad S. Khan, "Antennas and Wave propagation", TMH New Delhi, 4thEd, 2010.
2. SamuelY. Liao,"Micro wave devices and circuits", 3rdEdition,Pearson Publishing, 2003.

References:

1. R .E. Collin, "Foundations for micro wave engineering", 2ndEdition, JohnWiley,2002.
2. C.A. Balanis, "Antenna Theory-Analysis and Design", John Wiley & Sons, 2nd Edn. 2001.
3. M. Kulkarni, "Micro wave and Radar Engineering", Umesh Publications, 4th edition 2009.
4. G.S.NRaju, "AntennaandWavePropagation",PearsonEducationIndia,3rdEdition2009.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the generation of radiation and basic concepts of dipole and loop Antennas

CO2: Analyze the Practical antenna design characteristics to meet the requirements of modern wireless communications.

CO3: Understand the uses of antenna arrays and waveguides for propagation of EM wave.

CO4: Analyze various microwave components and the principles of different microwave sources.

CO5: Gain knowledge on Micro wave Amplifiers and Oscillators.

CO6: Measure the different Parameters of antennas and propagation of microwaves through waveguides.

DATA COMMUNICATION AND NETWORKS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0422T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

The student should be made to:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

Syllabus	Total Hours: 48

Unit –I	10 Hrs

Data Communications: Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview, topology, transmission mode, digital to digital encoding, transmission media guided and unguided, Switching: Circuit switching(space-division, time division and space-time division), packet switching (virtual circuit and Data gram approach), message switching.

Unit –II	10 Hrs

Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack.

Unit –III	10 Hrs

Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Bluetooth IEEE 802.16.Tokenring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

Unit –IV	9 Hrs

Network Layer: Design issues, Routing algorithms, Congestion control algorithms, Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6 and ICMPV6.

Unit –V	9 Hrs

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service. Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

Text Books:

1. S. Tannenbum, D. Wetherall, ―Computer Networks‖, Prentice Hall, Pearson, 5thEd.
2. Behrouz A. Forouzan, ―Data Communications and Networking‖, Tata McGraw-Hill, 4th Ed

References:

1. Fred Halsall, ―Computer Networks‖, Addison – Wesley Pub. Co. 1996.
2. Larry L, Peterson and Bruce S. Davie, ―Computer Networks: A system Approach‖, Elsevier, 4thEd
3. Tomasi, ―Introduction To Data Communications & Networking‖, Pearson 7th impression2011.
4. William Stallings, ―Data and Computer Communications‖, Prentice Hall, Imprint of Pearson, 9thEd.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the basics of data communication, networking, internet and their importance.

CO2: Analyze the services and features of various protocol layers in data networks.

CO3: Differentiate wired and wireless computer networks

CO4: Analyze TCP/IP and their protocols.

CO5: Understand the flow control and congestion control algorithms

CO6: Understand different internet devices and their functions.

INFORMATION THEORY AND CODING					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0423T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

- To teach the basic parameters of Information, the concepts of source coding techniques and error control coding techniques.
- To transmit knowledge on Information theory and error control coding techniques to solve problems.
- To Introduce various source coding and channel coding techniques for error detection and error correction in the information bearing signals.
- To describe various systems for linear block codes and convolutional codes.

Syllabus	**Total Hours: 48**
Unit –I	**10 Hrs**

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving. Block to Variable length Coding: Prefix-free Code – Coding a single Random Variable, Prefix- Free Code, Kraft Inequality, Bounds on optimal Code length – Coding a Single Random Variable, Rooted Tree with Probabilities, Shanon- Fano Coding – Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.

Unit –II	**10 Hrs**

Asymptotic Equi-partition Property – Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving.

Universal Source Coding: Lempel –Ziv Algorithm, LZ – 77 Encoding and Decoding, Lempel – Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.

Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut – Arimoto Algorithm - problem solving.

Unit –III	**10 Hrs**

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.

Unit –IV	**9 Hrs**

Linear Block Codes – Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.

Unit –V	**9 Hrs**

Convolutional Coding – Code Generation, Decoding Convolutional Code – the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

Text Books:

1. Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons, 2nd Edition, 2006.
2. Herbert Taub, Donald L Shilling, Goutam Saha, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.

References:

1. Shu Lin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.

Course Outcomes:

After the completion of the course students will able to:

CO1: Describe the basic parameters of Information, the concepts of source coding techniques, and Error Control coding techniques.

CO2: Apply the knowledge of Information theory and error control coding techniques to solve problems.

CO3: Analyze various source coding and channel coding techniques for error detection and error correction in the information bearing signals.

CO4: Compare various block to variable length coding and variable to block length coding techniques for merits and demerits. Also compare the performance of linear block codes and convolutional codes.

CO5: Design various systems for linear block codes and convolutional codes.

CO6: Implement the various source coding methods to improve the efficiency of information theory.

INDUSTRIAL ELECTRONICS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0424T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Syllabus	Total Hours: 48

Unit –I — **10 Hrs**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semi conductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

Unit –II — **10 Hrs**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

Unit –III — **10 Hrs**

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period .Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

Unit –IV — **9 Hrs**

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Unit –V — **9 Hrs**

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Textbooks:

1. Fundamentals of Industrial Electronics, Bogdan M Wilamowski, J David irwin, 2nd Edition, 2011.
2. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
3. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

References:

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the semi-conductor devices and their switching characteristics.

CO2: Apply the Ultrasonic waves with different applications.

CO3: Understand the working of Transistor and its different configurations.

CO4: Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters.

CO5: Develop the practical applications Electronics in industries.

CO6: Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry.

DATABASE MANAGEMENT SYSTEMS (Common to CE,EEE,ME and ECE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0512T	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To teach the role of database management system in an organization.
- To design databases using data modeling and Logical database design techniques.
- To construct database queries using relational algebra and calculus and SQL.
- To explore implementation issues in database transaction.
- To familiarize database security mechanisms.

Syllabus		Total Hours:48
Unit -I	**Introduction to Database concepts and Modeling**	**10Hrs**

Conceptual Modeling Introduction: Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture.

The Entity-Relationship Model: Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.

Unit -II	**Relational Model, Relational Algebra**	**9Hrs**

Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

Relational Algebra: Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

Unit -III	**SQL**	**10Hrs**

SQL: Basic form of SQL Query, DDL, DML queries, Views in SQL, Joins, Nested & Correlated queries, Operators, predefined functions, Aggregate Functions.

PL/SQL: Introduction, Functions & Procedures, Triggers, Cursors.

Unit -IV	**Normalization**	**9Hrs**

Relational database design: Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF, 3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.

Unit -V	**Transaction Management &Concurrency Control and Recovery**	**10Hrs**

Transaction Management: Transaction processing, Transaction Concept, Transaction States, Implementation of Atomicity and Durability, Concurrent Executions.

Concurrency Control: Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularities.

Recovery: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.
2. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Books:

1. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.
2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.
3. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education
4. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.
5. Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.
6. John V. ,Absolute beginner's guide to databases, Petersen, QUE

Web Resources:

1. https://www.coursera.org/learn/database-management
2. https://www.coursera.org/learn/sql-data-science
3. https://www.w3schools.com/sql/
4. https://www.youtube.com/watch?v=fHAfc7Hjq28&list=PLWPirh4EWFpGrpcMfZ6UcdI786QdtSxV8
5. https://www.youtube.com/watch?v=HwmEcudlv44&list=PL4OCRJojkV1jN-Ed6RkQpWfBvqe0utRd6
6. http://www.w3schools.in/dbms/
7. https://www.geeksforgeeks.org/dbms/
8. https://www.javatpoint.com/dbms-tutorial
9. https://www.edureka.co/blog/dbms-tutorial/

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Understand the Basic Concepts of Database languages, Relational model, SQL.

CO2: Choose the specific Data models for large enterprise database design.

CO3: Analyze the data efficiently through SQL instructions.

CO4: Apply Normal forms on database for eliminating the redundancy.

CO5: Demonstrate the Basic Concepts of transaction management techniques.

CO6: Apply concurrency control techniques for Database recovery.

POWER ELECTRONICS

(Common to all Except EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0214Ta	3:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries

Syllabus		Total Hours: 49 Hrs
Unit-I	**Power Semi Conductor Devices -I**	**10 Hrs**

Classification of Switching Devices Based on Frequency and Power Handling Capacity , Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors.

Unit-II	**Power Semi Conductor Devices-II**	**10 Hrs**

BJT – Power Transistor - Power MOSFET – Power IGBT – Static Characteristics – Turn On and Turn Off Methods SCR- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits- Series and Parallel Connections of SCR's – Specifications and Ratings of SCR's, BJT, IGBT

Unit -III	**Phase Controlled Converters**	**9 Hrs**

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Effect of Source Inductance – Numerical Problems.

Unit -IV	**Inverters**	**10 Hrs**

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems,

Unit -V	**Ac Voltage Controllers & Cyclo Converters**	**10 Hrs**

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R– Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems

Cyclo Converters – Single Phase Mid Point Cyclo converters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cyclo converter (Principle of Operation only) – Waveforms

Textbooks:

1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2007, 23rd Reprint 2015.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3rdEdition, 2014, 2nd Impression 2015

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Understand basic concepts of diode and transistor and its operation.

CO2: Understand the characteristics and usage of basic Power Semiconductor Devices.

CO3: Understand basic operating principles of power semiconductor switching devices.

CO4: Understand the Construction of power electronic converters, inverters, AC voltage controllers, and cyclo converters.

CO5: Understand the operation of power electronic converters, inverters, AC voltage controllers, and cyclo converters.

CO6: How to apply the learnt principles and methods to practical applications.

FUNDAMENTALS OF DRONE TECHNOLOGY					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0332Tc	**2: 1:0**	**3**	**CIE:30** **SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The course should enable the students to

- To make the students to understand the basic concepts of UAV drone systems.
- To introduce the stability and control of an aircraft

Syllabus		**Total Hours: 50**
UNIT-I	**Introduction to Drones**	**10 Hrs**
Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, applications		
UNIT-II	**Design of UAV Drone Systems**	**10Hrs**
Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Design Standards and Regulatory Aspects-India Specific, Design for Stealth.		
UNIT-III	**Avionics Hardware of Drones**	**10Hrs**
Autopilot, AGL-pressure sensors servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration.		
UNIT-IV	**Communication, Payloads and Controls**	**10Hrs**
Communication, Payloads and Controls: Payloads, Telemetry, Tracking, controls-PID feedback, radio control frequency range, modems, memory system, simulation, ground test-analysis-trouble shooting		
UNIT-V	**Navigation and Testing**	**10Hrs**
Navigation and Testing: Waypoints navigation, ground control software, System Ground Testing, System In-flight Testing, Future Prospects and Challenges		

Textbooks:

1. Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007

Reference Books:

1. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998
2. Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Understand the Concept of UAV, its components and its known applications.

CO2: Identify the type of drone and design a drone for a given application/specification.

CO3: Ability to design UAV drone system

CO4: To understand working of different types of engines and its area of applications.

CO5: To understand static and dynamic stability dynamic instability and control concepts

CO6: To know the loads taken by aircraft and type of construction and also construction materials.

BUILDING MATERIALS

(ME, CSE, AI&ML, CS, DS, ECE, EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0149T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To identify the traditional materials that are used for building constructions.
- To explain basic concepts of building components such as stair case and masonry
- To know the causes of dampness in structures and its preventive measures
- To understand the building rules, building bye laws and acoustics of building

Syllabus		Total Hours: 48
Unit-I	**MATERIALS**	**9 Hrs**
Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works		
Unit-II	**BUILDING COMPONENTS**	**9 Hrs**
Lintels, Arches and Vaults – Staircases, Lifts – Types. Different types of flooring-Concrete, Mosaic, Terrazo floors; Different types of roofs- Pitched, Flat and Curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs - King and Queen Post Trusses. Doors & Windows- Types and Specifications		
Unit -III	**DAMPNESS**	**10 Hrs**
Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.		
Unit -IV	**BUILDING PLANNING**	**10 Hrs**
Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements		
Unit -V	**BUILDING RULES AND BYE-LAWS**	**10 Hrs**
Zoning regulations; Regulations regarding layouts or subdivisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index. Building Information System		

Textbooks:

1. Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki, Tata McGraw-Hill, New
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, ‚Building Construction' - Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. N. Kumaraswamy, A. Kameswara Rao, building planning and drawing, 7th Ed, Charotar

E-resources:

1 http://nptel.ac.in/courses/105104103/
2. http://www.academicpub.org/jwrhe/
3. http://www.peo.on.ca/index.php/ci_id/21843/la_id/1

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: To understand the characteristics of different building materials.

CO2: Differentiate brick masonry, stone masonry construction and bonds used in construction of walls of buildings.

CO3: To know about the causes of dampness in buildings and its ill effects.

CO4: To understand the principles of planning in buildings.

CO5: Describe capable of understanding building rules.

CO6: Acquire the knowledge about bye-laws and building elements.

DIGITAL SYSTEM DESIGN THROUGH VERILOG LAB

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0425P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To understand and develop HDL(Verilog) source code for the given problem/experiment
- To analyze the obtained results of the given experiment/problem
- To simulate the given circuit with suitable simulator and verify the results
- To understand how to use FPGA/CPLD hardware tools in the lab
- To design and implement the experiments using FPGA/CPLD hardware tools

Syllabus

LIST OF EXPERIMENTS: (**Conduct Any 10 experiments**).

1. Realization of Logic gates
2. Design and Implementation of an Inverter
3. Design and Implementation of Full adder.
4. Design and Implementation of Full Subtractor
5. Design and Implementation of 4-bitcomparator.
6. Design and Implementation of 4-bit ripple carry and carry look ahead adder
7. Design and Implementation of 16:1 mux through 4:1 mux
8. Design and Implementation of 3:8 decoder realization through 2:4 decoder
9. Design and Implementation of 8:3 encoder
10. Design and Implementation of 8-bit parity generator and checker
11. Design and Implementation of different Flip-Flops
12. Design and Implementation of 8 bit up-down counter
13. Design and Implementation of 4bit sequence detector through Mealy and Moore state machines.

Software Required:

i) FPGA Programming Software like Xilinx Vivado / Altera (Intel) / Cypress / Equivalent Industry Standard Software

ii) Personal computer system with necessary software to run the programs and to implement

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand HDL(Verilog) source code for the given problem/experiment

CO2: Develop HDL(Verilog) source code for the given problem/experiment

CO3: Analyze the obtained results of the given experiment/problem

CO4: Simulate the given circuit with suitable simulator and verify the results

CO5: Understand how to use FPGA/CPLD hardware tools in the lab

CO6: Design and implement the experiments using FPGA/CPLD hardware tools

ANTENNAS & MICROWAVE ENGINEERING LAB					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0426P	**0:0:3**	**1.5**	**CIE:30** **SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To make students to understand various antennas
- To understand the working of different micro wave components and verify characteristics using micro wave bench setup.

Syllabus

Part-A: Antennas Lab

- To analyze the characteristics of Simple Dipole λ/2 and λ/4 Antenna
- To analyze the variation in the Radiation Strength at given distance from Antenna
- To analyze the Reciprocity Theorem for Antennas
- To study Folded Dipole λ/2Antenna
- Study of Yagi Uda 3element Folded Dipole, 5element folded dipole.
- To analyze the characteristics of micro strip antennas
- To analyze the characteristics and radiation pattern of broad side and end fire arrays.

Part-B: Micro wave Engineering lab

- Reflex Klystron Characteristics.
- Gunn Diode Characteristics.
- Directional Coupler Characteristics.
- VSWR Measurement.
- Measurement of Wave Guide Parameters.
- Measurement of Scattering Parameters of a Magic Tee.
- Attenuation Measurement.
- Microwave Frequency Measurement

NOTE: At least 5 Experiments from each section must be done in the semester.

Course Outcomes:

After the completion of the course students will able to:

CO1: Analyze performance characteristics of Antennas

CO2: Understand the working, different microwave components and sources in a microwave bench

CO3: Verify the characteristics of various microwave components using microwave bench setup.

CO4: Verify Theorems applicable for antennas

CO5: Measure scattering parameters of microwave components.

CO6: Measure Attenuation and frequency of microwave.

SOFT SKILLS					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0428P	**1:0:2**	**2**	**CIE:30 SEE:70**	**3Hours**	**SC**

Course Objectives:

- To encourage all round development of the students by focusing on soft skills.
- To make the students aware of critical thinking and problem-solving skills.
- To develop leadership skills and organizational skills through group activities.
- To function effectively with heterogeneous teams.

Syllabus **Total Hours:45**

Unit -I	**Soft Skills & Communication Skills**	**9Hrs**

Introduction, meaning, significance of soft skills –Vital Components of communication skills - Inter-personal skills - Verbal and Non-verbal Communication.

Activities: Narration about self- strengths and weaknesses- clarity of thought - Interpersonal Skills- Group Discussion – Debate – Mutual Understanding - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- Negotiation skills –Role Play- Non-verbal communication – Public speaking – Mock interviews – Anchoring Skills.

Unit -II	**Critical Thinking**	**9Hrs**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking.

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

Unit -III	**Problem Solving & Decision Making**	**9Hrs**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles.

Activities: Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

Unit -IV	**Emotional Intelligence & Stress Management**	**9Hrs**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, and sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

Unit -V	Leadership Skills	9Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management.

Activities: Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

Text Books:

1. Personality Development and Soft Skills (English, Paperback, MitraBarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

References:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications, 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press .
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India.

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

Course Outcomes:

After the completion of the course students will able to :

CO1: Memorize various elements of effective communicative skills.

CO2: Interpret people at the emotional level through emotional intelligence.

CO3: Apply critical thinking skills in problem solving.

CO4: Analyze the needs of an organization for team building.

CO5: Judge the situation and take necessary decisions as a leader.

CO6: Develop social and work-life skills as well as personal and emotional well-being.

DESIGN THINKING AND INNOVATION
(Common to CSE, AIML, CS, DS, CE, EEE, ME and ECE)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
22A0526	2:0:0	0	CIE:30	-	MC

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Syllabus		Total Hours:48
Unit -I	**Introduction to Design Thinking**	**9Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit -II	Design Thinking Process	9Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit -III	Innovation	10Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit -IV	Product Design	10Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit -V	Design Thinking in Business Processes	10Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.

Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Define the concepts related to design thinking.

CO2: Explain the fundamentals of Design Thinking and innovation

CO3: Apply the design thinking techniques for solving problems in various sectors.

CO4: Analyze to work in a multidisciplinary environment

CO5: Evaluate the value of creativity

CO6: Formulate specific problem statements of real time issues

Semester - 6 (Theory-7, Lab-3, MC-1)						
Category	**Course Code**	**Course Title**	**Hours per week**			**Credits**
			L	**T**	**P**	**C**
PCC	22A0434T	Microprocessor and Microcontroller	3	0	0	3
PCC	22A0435T	Digital Signal Processing	3	0	0	3
PCC	22A0436T	VLSI Design	3	0	0	3
PEC		**Professional Elective-II:**	3	0	0	3
OEC		**Open Elective-II:**	3	0	0	3
PCC (Lab)	22A0440P	Microprocessor and Microcontroller Lab	0	0	3	1.5
PCC (Lab)	22A0441P	VLSI Design Lab	0	0	3	1.5
PCC (Lab)	22A0442P	Digital Signal Processing Lab	0	0	3	1.5
SC	22A0539	**Skill Oriented Course:** JAVA Programming	1	0	2	2
MC	22A0032M	**Mandatory Course:** Research Methodology	2	0	0	0
					Total credits	**21.5**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation						

S. No.	Course Code	Name of the Professional Elective-II
1	22A0437T	Electronic Measurements and Instrumentation
2	22A0438T	Sensors & Actuators
3	22A0439T	Radar and Satellite Communications

S. No.	Course Code	Name of the Open Elective-II
1	22A0528T	Machine Learning
2	22A0238Ta	Modern Control theory
3	22A0150T	Environmental Economics
4	22A0027T	Organizational Behaviour

Category	Credits
Professional Core Courses (PCC)	13.5
Professional Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Oriented Course (SC)	2
Industrial/Research Internship (Mandatory) 2 Months	-
Total	21.5

MICROPROCESSOR AND MICROCONTROLLER

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0434T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051
- To introduce16 bit and 32 bit microcontrollers.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

Unit –II	10 Hrs

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

Unit –III	10 Hrs

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

Unit –IV	9 Hrs

Microcontroller - Architecture of 8051 –Addressing modes - I/O Pins Ports and Circuits - Instruction set - Arithmetic & Logic Instructions And Programs-Assembly language programming- 8051 Programming in C.

Unit –V	9 Hrs

Interfacing Microcontroller–Timers/ Counters , Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, Introduction to RISC processors

Textbooks:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Kenneth J. Ayala, the 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

Course Outcomes:

After the completion of the course students will able to:

CO1: Distinguish between microprocessors & microcontrollers

CO2: Develop assembly language programming

CO3: Describe interfacing of 8086 with peripheral devices

CO4: Understand the concept of Microcontrollers

CO5: Design applications using microcontrollers

CO6: Design external Memory Interface using microcontroller.

DIGITAL SIGNAL PROCESSING

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0435T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

Syllabus		Total Hours: 48
Unit –I	**Introduction to discrete time signals and systems**	**10 Hrs**

Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Unit-II	Discrete Fourier Transform & Fast Fourier Transform	10 Hrs

Discrete Fourier Transform - Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform - Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

Unit-III	IIR Filters	10 Hrs

IIR Filters-Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods , Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations

Unit-IV	FIR Filters	9 Hrs

FIR Filters-Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations

Unit-V	Multi rate Digital Signal Processing	9 Hrs

Multi rate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Applications.

Textbooks:

1. Digital Signal Processing, Principles, Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, Pearson Education, 2007.
2. Discrete Time Signal Processing, A.V.Oppenheim and R.W. Schaffer, PHI.

Reference Books:

1. Digital Signal Processing – A practical approach, S.K.Mitra, 2nd Edition, Pearson Education, New Delhi, 2004.
2. Digital Signal Processing, Schaum's Outline series, MH Hayes, TATA Mc-Graw Hill, 2007.
3. Fundamentals of Digital Signal Processing using Matlab, Robert J. Schilling, Sandra L. Harris, Thomson, 2007.

Course Outcomes (CO):

After the completion of the course students will able to:

CO1: Understand the basic concepts of discrete time signals and systems.

CO2: Formulate difference equations for the given discrete time systems

CO3: Apply FFT algorithms for determining the DFT of a given signal

CO4: Compare FIR and IIR filter structures

CO5: Design digital filter (FIR & IIR) from the given specifications

CO6: Understand the concept of multi rate DSP and applications of DSP

VLSI DESIGN					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0436T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behaviour of inverters designed with various loads.
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To provide concepts to design building blocks of data path of any system using gates.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Syllabus	**Total hours: 48**
Unit –I::Introduction to Fabrication Process	**10 Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.

Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Unit –II::Basic Electrical Properties of MOS/BiCMOS & Circuits Concepts	**10 Hrs**

Basic Electrical Properties: Ids Vs Vds relationships , MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Unit –III:: VLSI Circuit Design Processes	**10 Hrs**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Unit –IV:: Basic building blocks of Analog IC design & Static/Dynamic CMOS Design	**9 Hrs**

Analog IC design: Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, current sources and sinks.

Static CMOS Design: Complementary CMOS, Rationed Logic, Pass-Transistor Logic

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style.

Unit –V::CMOS Testing	**10 Hrs**

CAD Tools for Design and Simulation, Aspects of Design Tools, Test and Testability-System Partitioning, Layout and Testability, Reset/Initialization, Design for Testability ,Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Text Books:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003
3. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, reprint 2009
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

Course Outcomes:

After the completion of the course students will able to:

CO1: Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.

CO2: Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices

CO3: Apply the basic circuit concepts to MOS circuits.

CO4: Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.

CO5: Design MOSFET based Analog IC Design and MOSFET based logic circuits using various logic styles like static and dynamic CMOS

CO6: Understand the concept of testing and adding extra hardware to improve testability of system.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0437T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- It provides an understanding of various measuring system functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Understanding the concepts of various measuring bridges and their balancing conditions.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Syllabus	Total Hours: 48

Unit –I	10 Hrs

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

Unit –II	10 Hrs

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

Unit –III	9 Hrs

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications. Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

Unit –IV	10 Hrs

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

Unit –V	9 Hrs

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

Text Books:

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

References:

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

Course Outcomes:

After the completion of the course students will able to:

CO1: Measure electrical parameters with different meters and understand the basic definition of measuring parameters.

CO2: Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

CO3: Operate an Oscilloscope to measure various signals.

CO4: Measure various physical parameters by appropriately selecting the transducers.

CO5: Understand the design of oscilloscopes for different applications.

CO6: Design different transducers for measurement of different parameters.

SENSORS AND ACTUATORS					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0438T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

- To understand modelling concept;
- To get exposed with basics of Sensors, Actuators and Mechatronics;
- To learn different types of Sensors;
- To study MEMS and smart Sensors;
- To study few case studies on advanced driver assistance system and self driving cars as Applications of Sensors, actuators and Mechatronics concepts.
- To develop problem solving skills and experience in real time applications through few case studies

Syllabus	**Total Hours: 48**
Unit –I:: Sensors	**10 Hrs**

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

Unit –II:: Transducers	**9 Hrs**

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor

Unit –III:: Actuators	**10 Hrs**

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.

Electrical Actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

Unit –IV:: Micro Sensors and Micro Actuators	**10 Hrs**

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

Unit –V:: Sensor Materials and Processing Techniques	9 Hrs

Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.

Text Books:

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

References:

1. Robert H Bishop, "The Mechatronics Hand Book", CRCPress, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
4. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.

Course Outcomes:

After the completion of the course students will able to:

CO1: Explain fundamental physical and technical base of sensors andactuators,

CO2: Describe basic laws and phenomena that define behaviour ofsensors and actuators.

CO3: Analyze various premises, approaches, procedures and resultsrelated to sensors and actuators.

CO4: Create analytical design and development solutions for sensorsand actuators.

CO5: Describe development and application of sensors and actuators

CO6: Understanding basic laws and phenomena on which operation ofsensors and actuators-transformation of energy.

RADAR & SATELLITE COMMUNICATIONS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0439T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To explore the concepts of radar and its frequency bands.
- To understand Doppler Effect and get acquainted with the working principles of CW radar, FM-CW radar.
- To impart the knowledge of functioning of MTI and Tracking Radars, design of a Matched Filter in radar receivers.
- To acquire foundation in orbital mechanics and launch vehicles for the satellites.
- To understand the concepts of satellite navigation and GPS.

Syllabus	Total Hours: 48

Unit –I — 10 Hrs

Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems.

Radar Equation : Modified Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

Unit –II — 10 Hrs

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems, FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

Unit –III — 9 Hrs

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

Detection of Radar Signals in Noise : Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Noise Figure and Noise Temperature.

Unit –IV — 10 Hrs

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics And Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

Unit –V	9 Hrs

Satellite Sub Systems: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

Satellite Navigation &Global Positioning System: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

Text Books:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.
2. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2ndEdition, 2003.

References:

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996
4. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Course Outcomes:

After the completion of the course students will able to:

CO1: Derive the radar range equation and to solve some analytical problems.

CO2: Understand the different types of radars and its applications.

CO3: Describe the need and functioning of CW, FM-CW and MTI radars.

CO4: Apply the concept of tracking and different tracking techniques, various components of radar receiver and its performance.

CO5: Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.

CO6: Analyze the concepts of GEO Stationary Satellite Systems and satellite navigation.

MACHINE LEARNING
(Common to CE,EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0528T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Syllabus		Total Hours:48
Unit -I	**Introduction – Human Learning & Machine Learning**	**10Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Basic types of Data in Machine Learning, Data Preprocessing : Data Cleaning, Data transformation and Data Reduction

Unit -II	**Modeling and Evaluation**	**9Hrs**

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Unit -III	**Supervised Learning :Classification**	**10Hrs**

Classification – Methods of Classification : Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Unit -IV	**Supervised Learning : Regression**	**10Hrs**

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Unit -V	**Unsupervised Learning : Clustering**	**9Hrs**

Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoid's algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS

Text Books:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Web Resources:

1. Andrew Ng, “Machine Learning Yearning”
2. https://www.deeplearning.ai/machine-learning-
3. https://www.cse.huji.ac.il/~shais/Understanding MachineLearning/index.html

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Identify machine learning techniques suitable for a given problem

CO2: Characterize the machine learning algorithms as supervised learning and unsupervised learning

CO3: Solve the problems using various machine learning techniques

CO4: Design application using machine learning techniques

CO5: Analyze and Apply the suitable supervised learning methods for real-world problems

CO6: Understand the features of machine learning to apply on real world problems

MODERN CONTROL THEORY (Only ECE)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0238Ta	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of the course are to make the students learn about:

- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

Syllabus		**Total Hours:49**
Unit-I	**State Variable Description and Solution of State Equation**	**10 Hrs**

Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems

Unit-II	**Controllability and Observability**	**10 Hrs**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

Unit -III	**State Feedback Controllers and Observers**	**9 Hrs**

Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters

Unit -IV	**Analysis of Nonlinear Systems**	**10 Hrs**

Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase plane analysis of nonlinear control systems.

Unit -V	**Stability Analysis**	**10 Hrs**

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems

Textbooks:

1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2nd edition, 2005.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Model a given dynamic system in state space and obtain the solution for the state equation

CO2: Test whether a given system is controllable and/or observable

CO3: Design a state feedback controller for pole placement

CO4: Design an observer for state estimation

CO5: Apply Lyapunov criterion and determine stability of a given system.

CO6: Analyze nonlinear systems

ENVIRONMENTAL ECONOMICS

(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0150T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Syllabus — **Total Hours:48**

Unit-I	Sustainable Development	9 Hrs

Introduction to sustainable development - Economy-Environment inter linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy

Unit-II	Environmental Degradation	9 Hrs

Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

Unit -III	Economics of Pollution	10 Hrs

Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

Unit -IV	Cost – Benefit Analysis	10 Hrs

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

Unit -V	Economics Of Biodiversity	10 Hrs

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Textbooks:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),

E-resources:

1. https://nptel.ac.in/courses/109107171

Course Outcomes(CO):

On completion of this course, student will be able to

CO1: Understand the information on sustainable development and economics of energy

CO2: Understand the information regarding environmental degradation

CO3: Understand the information regarding economic analysis of degradation

CO4: The identification of economics of pollution and their management

CO5: The cost benefit analysis of environmental resources.

CO6: The principles of economics of biodiversity

ORGANIZATIONAL BEHAVIOUR					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0027T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- To enable the students to understand the functions and principles of management.
- To help the students to develop cognizance of the importance of organization behaviour.
- To enable students to understand the leading and motivation.
- Determine the various factors associated with organizational culture.
- Develop the group dynamics in developing team building.

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Management**	**10Hrs**
Nature, Scope and Functions - Principles of Management, Evolution of Management thought: Scientific Management theory, Bureaucracy theory, Administrative theory, Behavioural, Human Relations Approach - Modern Theory - Quantitative Approach, Systems and Contingency.		
Unit -II	**Introduction to Organizational Behavior**	**9Hrs**
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective-Understanding Individual Behaviour–Attitude -Perception –Learning – Personality.		
Unit -III	**Perception &Motivation**	**10Hrs**
Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory		
Unit -IV	**Organizational Culture**	**9Hrs**
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader.		
Unit -V	**Group Dynamics**	**10Hrs**
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building –Conflict Management - Conflict in the organization– Conflict resolution		

Textbooks:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12th edition 2011
2. P Subba Rao, Organisational Behaviour, Himalya Publishing House2017

Reference Books:

1. McShane, Organizational Behaviour, TMH 2009
2. Nelson, OrganisationalBehaviour, Thomson,2009.
3. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson2009.
4. Aswathappa, Organisational Behaviour, Himalaya,2009

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the managerial functions and have some basic knowledge on various aspect of management.

CO2: Develop cognizance of the importance of organization behaviour

CO3: Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization

CO4: Demonstrate the ability to leading and motivation in organization

CO5: Develop the importance of Organizational leadership & culture

CO6: Build team building, group dynamics, group process, group norms to resolve conflicts in organization.

MICROPROCESSOR AND MICROCONTROLLER LAB					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0440P	**0:0:3**	**1.5**	**CIE:3 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- Formulate problems and implement algorithms using Assembly language.
- Develop programs for different applications.
- Interface peripheral devices with 8086 and 8051.
- Use Assembly/Embedded C programming approach for solving real world problems

Syllabus

MINIMUM TWO EXPERIMENTS MUST CONDUCT:

List of Experiments:

1. PROGRAMS FOR 16 BIT ARITHMETIC OPERATIONS (Using various addressing modes)
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.
2. PROGRAMS INVOLVING BIT MANIPULATION INSTRUCTIONS
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.
3. PROGRAMS ON ARRAYS FOR 8086
   a) Write an ALP to find Addition/subtraction of N no 's.
   b) Write an ALP for finding largest/smallest no.
   c) Write an ALP to sort given array in Ascending/descending order.
4. PROGRAM FOR STRING MANIPULATIONS FOR 8086
   a) Write an ALP to find String length.
   b) Write an ALP for Displaying the given String.
   c) Write an ALP for Comparing Two Strings.
   d) Write an ALP to reverse String and Checking for palindrome.
5. PROGRAM FOR DIGITAL CLOCK DESIGN USING 8086
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock using DOS Interrupt Functions.
   c) Write an ALP for Designing clock by reading system time.
6. INTERFACING STEPPER MOTOR WITH 8086
   a) Write an ALP to 8086 processors to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
   b) Write an ALP to 8086 processors to Interface a stepper motor and operate it in Anti clockwise by choosing variable step-size.
7. INTERFACING ADC/DAC WITH 8086
   a) Write an ALP to 8086 processors to Interface ADC.
   b) Write an ALP to 8086 processors to Interface DAC and generate Square Wave/Triangular Wave/Step signal.
8. COMMUNICATION BETWEEN TWO MICROPROCESSORS
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251.
9. PROGRAMS USING ARITHMETIC AND LOGICAL INSTRUCTIONS FOR 8051
   a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction, Multiplication and Division.

b) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
c) Programs related to Register Banks.

10. PROGRAM TO VERIFY TIMERS/COUNTERS OF 8051
    a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
    b) Write a program to create a delay of 50 μsec using Timer1 in mode 0 and blink all the Pins of P2.
    c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
    d) Write a program to create a delay of 80 μsec using counter1 in mode 1 and blink all the Pins of P3.
11. UART OPERATION IN 8051
    a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
    b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
    c) Write a program to transfer a character serially with a baud rate of 2400 using UART.
12. INTERFACING LCD WITH 8051
    a) Develop and execute the program to interface16*2 LCD to 8051.
    b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd
3. edition2006.
4. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice GillispieMazidi, Second Edition.

Course Outcomes:

After the completion of the course students will able to:

CO1: Interface the peripheral devices with 8086 microprocessors.

CO2: Interface the peripheral devices with 8051microcontrollers.

CO3: Develop the algorithms using Assembly language.

CO4: Develop programs using embedded C language for different applications.

CO5: Develop the Assembly language programming approach for solving real world problems.

CO6: Develop the Embedded C programming approach for solving real world problems.

VLSI DESIGN LAB					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0441P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- Design any logic circuit using CMOS transistor.
- Use different software tools for analysis of circuits.
- Design layouts to the CMOS circuits.
- Use different software tools for analog layout

Syllabus

LIST OF EXPERIMENTS: (**Conduct Any 10 experiments**)

1. Design and analysis of CMOS Inverter
   a) Implement CMOS inverter schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CMOS Inverter and check its output response.
   c) Perform DC and AC analysis for CMOS inverter.
   d) Check the performance of CMOS inverter using parametric sweep.
2. Design and analysis of NAND and NOR Logic gates
   a) Implement NAND/NOR schematic using 90 nm technology and design its symbol.
   b) Implement test bench for NAND/NOR and check its output response.
   c) Perform DC and AC analysis for NAND/NOR.
   d) Check the performance of NAND/NOR using parametric sweep.
3. Design and analysis of XOR and XNOR Logic gates
   a) Implement XOR/XNOR schematic using 90 nm technology and design its symbol.
   b) Implement test bench for XOR/XNOR and check its output response.
   c) Perform DC and AC analysis for XOR/XNOR.
   d) Check the performance of XOR/XNOR using parametric sweep.
4. Design of AOI logic
   a) Design Schematic for AB+C‘D and check its output response.
   b) Design Schematic for AB‘+C‘D and check its output response.
   c) Design Schematic for (A+B‘)(C+D) and check its output response.
   d) Design Schematic for (A+B‘)(C‘+D) and check its output response.
5. Design and analysis of Full adder
   a) Design full adder using Full custom IC design.
   b) Design full adder using Semi custom IC design.
6. Analysis of NMOS and PMOS characteristics
   a) Implement test bench for NMOS/PMOS transistor.
   b) Perform DC and AC analysis for NMOS/PMOS transistor
   c) Check the performance of NMOS/PMOS transistor using parametric sweep.
7. Design and analysis of Common source amplifier
   a) Implement CS amplifier schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CS amplifier and check its output response.
   c) Perform DC and AC analysis for CS amplifier.

d) Check the performance of CS amplifier using parametric sweep.

8. Design and analysis of Common drain amplifier
   a) Implement CD amplifier schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CD amplifier and check its output response.
   c) Perform DC and AC analysis for CD amplifier.
   d) Check the performance of CD amplifier using parametric sweep.
9. Design of MOS differential amplifier
   a) Design differential amplifier schematic using 90 nm technology and its symbol.
   b) Implement test bench for differential amplifier and check its output response.
   c) Perform DC and AC analysis for differential amplifier.
   d) Check the performance of differential amplifier using parametric sweep.
10. Design of two stage differential amplifier
   a) Design two stage differential amplifier schematic using 90 nm technology and its symbol.
   b) Implement test bench for two stage differential amplifier and check its output response.
   c) Perform DC and AC analysis for two stage differential amplifier.
   d) Check the performance of two stage differential amplifier using parametric sweep.
11. Design of Inverter Layout
   a) Design and implement inverter schematic.
   b) Design the layout for inverter using 90 nm tech file.
   c) Perform LVS for schematic and layout
   d) Check and remove all DRC violations.
   e) Extract parasitic R and C in layout.
12. Design of NAND/NOR Layout
   a) Design and implement NAND/NOR schematic.
   b) Design the layout for inverter using 90 nm tech file.
   c) Perform LVS for schematic and layout
   d) Check and remove all DRC violations.
   e) Extract parasitic R and C in layout

Software Required:

i. Mentor Graphics Software / Equivalent Industry Standard Software.

ii. Personal computer system with necessary software to run the programs and to implement

Course Outcomes:

After the completion of the course students will able to:

CO1: Apply switching theory to the design logic theory problems.

CO2: Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.

CO3: Design and simulate combinational and sequential digital circuits.

CO4: Design of various MOS differential amplifier

CO5: Design and analysis of Common drain amplifier and Perform DC and AC analysis

CO6: Design of NAND/NOR Layout and Extract parasitic R and C in layout

DIGITAL SIGNAL PROCESSING LAB					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0442P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).

Note: Any TWELVE of the experiments are to be conducted.

1. Generate the following standard discrete time signals.
   i)Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Saw tooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Study the generation of up- Sampling & Down sampling.
5. Implement and verify auto correlation for the given sequence and cross correlation between twogiven signals.
6. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
7. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
8. Implement and verify N-point IFFT of a given sequence.
9. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
10. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
11. Design FIR filter (Low Pass Filter /High Pass Filter) using different window techniques (rectangular, hamming and Kaiser)
12. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
13. Compute the Decimation and Interpolation for the given signal.
14. Real time implementation of an audio signal using a digital signal processor.
15. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

References:

1. Stephen J. Chapman, "MATLAB Programming for Engineers", Cengage, November 2012

Online Learning Resources/Virtual Labs:

1. https://www.vlab.co.in

Course Outcomes:

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

CO1: Implement various DSP Algorithms using MATLAB.

CO2: Implement DSP algorithms with Digital Signal Processor.

CO3: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth filters.

CO4: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR- Chebyshev filters.

CO5: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.

CO6: Analyze and implement various digital filters.

JAVA PROGRAMMING
(Common to EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0539	1:0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java

Syllabus | **Total Hours:48**

Module : 1

Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP: Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation..

Task: introduction to Object Oriented Programming and its basic concepts.

Module : 2

Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.

Task: Differences between Java and C++, Execute "Hello welcome to java" program

Module : 3

Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals- String Literals, Variables, Keywords, Data types.

Task: implementing data types with variables, find valid/invalid variables, Identifiers

Module : 4

Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.

Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5

Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with String.format( )

Task: Write a program using I/O statements in java.

Module : 6

Control Structures: Conditional control statements :- if ..statement, if… else statement- if-else-if ladder, Switch statement

Task: Write a program to find a person is eligible for vote >18?, Largest number among 3 numbers?

Module : 7

Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement, Continue statement-Break statement.

Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

Module:8

Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:-Two-dimensional arrays, Creating a two-dimensional array.

Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

Module : 9

Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings

Task: write a program to Perform all string operations as single output

Module : 10

Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading

Task: To implement Class and Object concept, Method Overloading program

Module :11

Interfaces: Interface, Multiple Inheritance using Interfaces.

Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,

Task: Implement a program using exception handling, write a program Multiple Inheritance using Interfaces.

Module : 12

Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads

Task: Implement a program using Threads.

Reference Books:

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web References:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

Course Outcomes (CO):
On completion of this course, student will be able to **CO1:** Understand the basic concepts of OOP **CO2:** Compare & Contrast basic constructs of C++ & Java **CO3:** Develop a program on operators in Java **CO4:** Apply Control statements to solve real time problems **CO5:** Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java **CO6:** Implementing different types of Threads to solve real time problems

RESEARCH METHODOLOGY					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0032M	**3-0-0**	**0**			**MC**

Course Objectives:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

Syllabus		**Total Hours: 30**
Unit -I	**. Foundations of Research**	**6 Hrs**

Meaning of Research –Objectives of Research –Types of Research –Research Approaches – Guidelines for Selecting and Defining Research Problem –Research Design –Concepts related to Research Design –Basic Principles of Experimental Design.

Unit -II	**Sampling Design**	**7 Hrs**

Sampling Design –steps in Sampling Design –Characteristics of a Good Sample Design –Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement –Tests of Sound Measurement –Scaling and Scale Construction Techniques –Time Series Analysis –Interpolation and Extrapolation. Data Collection Methods –Primary Data –Secondary data –Questionnaire Survey and Interviews.

Unit -III	**Data Analysis**	**6 Hrs**

Correlation and Regression Analysis –Method of Least Squares –Regression vs Correlation – Correlation vs Determination –Types of Correlations and Their Applications

Unit -IV	**Interpretation of Data**	**6 Hrs**

Statistical Inference: Tests of Hypothesis –Parametric vs Non-parametric Tests –Hypothesis Testing Procedure –Sampling Theory –Sampling Distribution –Chi-square Test –Analysis of variance and Co-variance –Multivariate Analysis

Unit -V	**Report Writing and Professional Ethics**	**5 Hrs**

Report Writing and Professional Ethics: Interpretation of Data –Report Writing –Layout of a Research Paper –Techniques of Interpretation-Making Scientific Presentations in Conferences and Seminars –Professional Ethics in Research.

Textbooks:

1. C.R.Kothari,"Research Methodology:Methods and Techniques",2nd edition, New Age International PublishersMathis,JohnH.Jackson,
2. AStep by Step Guide for Beginners,"Research Methodology": Ranjit Kumar, Sage Publications.

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1stEdition,Excel Books,New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9thedition.
3. S C Gupta, "Fundamentals of Statistics",7thedition Himalaya Publications

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand basic concepts of research and research problem
CO2: Demonstrate the knowledge of research processes

CO3: Read, comprehend and explain research articles in their academic discipline

CO4: Analyze various types of testing tools used in research

CO5: Understand the method of writing a research report
CO6: Design a research paper without any ethical issues

Semester – 7 (Theory-7)							
Sl. No.	**Category**	**CourseCode**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PEC		**Professional Elective-III**	3	0	0	3
2	PEC		**Professional Elective-IV**	3	0	0	3
3	PEC		**Professional Elective-V**	3	0	0	3
4	OEC		**Open Electives-III**	3	0	0	3
5	OEC		**Open Electives-IV**	3	0	0	3
6	HSC		**Open Elective-V:**	3	0	0	3
7	SC	22A0458P	**Skill Advanced Course:** Mobile Application Development	1	0	2	2
8		22A0460	Evaluation of Industry Internship	0	0		3
						Total credits	**23**

S. No.	Course Code	Name of the Professional Electives
1	22A0449T	Mobile Communications
2	22A0450T	Low Power VLSI Design
3	22A0451T	Embedded Real Time Systems
4	22A0452T	Fuzzy sets, logic systems and Applications
5	22A0453T	Advanced Digital Signal Processing
6	22A0454T	Internet of Things
7	22A0455T	CPLD & FPGA Architectures and Applications
8	22A0456T	Digital Image Processing
9	22A0457T	Digital TV Engineering

S. No.	Course Code	Name of the Open Electives
1	22A0529T	Cloud Computing
2	22A0241Ta	Smart Grid
3	22A0330Ta	Measurements and Mechatronics
4	22A0151T	Disaster Management
5	22A0534b	Cyber Security
6	22A0327Ta	Renewable Energy Sources
7	22A0152T	Construction Management
8	22A0232Ta	Electric Vehicles
9	22A3301T	Artificial Intelligence
10	22A0024T	Entrepreneurship & Innovation
11	22A0023T	Management Science
12	22A0026T	Business Environment
13	22A0033T	Human Resource Management

Category	Credits
Professional Elective Courses (PEC)	9
Humanities and Social Science Course (HSC)	3
Open Elective Courses (OEC)	6
Skill Advanced Course (SC)	2
Industrial/Research Internship	3
Total	23

MOBILE COMMUNICATIONS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0449T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To impart knowledge on different wireless standards and their technical specifications.
- To teach different propagation models.
- To present concepts of 3G/4G Wireless Communication systems to solve the relevant Problems.
- To dissimilate different Wireless Technologies such as CDMA, MIMO, and OFDM through performance metrics to find the merits and demerits.

Syllabus	Total hours: 48

Unit –I — **10 Hrs**

Wireless Standards: Introduction to 3G/4G Wireless Communications - Introduction, 2G, 3G, and 4G Wireless standards, Overview of Cellular Service Progression, Problem Solving.

Teletraffic Theory: Introduction to teletraffic theory, Cellular traffic modelling and blocking probability.

Large Scale Path Loss: Introduction to wireless propagation models, Ground reflection model, Okumura model, Hata model, Link budget analysis, Log normal shadowing.

Unit –II — **10 Hrs**

Small Scale Fading and Multipath: Fading in wireless channel, Rayleigh fading, BER in wired and wireless channels. Wireless channel and delay spread, Coherence bandwidth of wireless channel, ISI and Doppler in wireless channel, Doppler spectrum and Jake's model.

Diversity Techniques: Introduction to diversity techniques, MRC for multi-antenna system, BER with diversity, Spatial diversity and diversity order.

Unit –III — **9 Hrs**

Basics of Channel Modeling: Maximum Delay Spread, RMS delay Spread, Power delay profile, Coherence Bandwidth, Doppler Spread, Impact of Doppler spread on Wireless Channel, Coherence Time, Clarke's Model, Simulation Procedure for flat fading and Frequency Selective Fading Channels.

Code Division Multiple Access: Introduction to CDMA, spread spectrum and LFSR. Generation and properties of PN sequences, Correlation of PN sequences and Jammer margin, CDMA advantages and RAKE receiver, Multiuser CDMA downlink, Multiuser CDMA uplink and asynchronous CDMA, CDMA near-far problem.

Unit –IV — **10 Hrs**

3G Overview: Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

Multiple Input Multiple Output Systems: Introduction to MIMO, MIMO system model, Zero-forcing receiver, MIMO MMSE receiver, Introduction to SVD, SVD based optimal MIMO transmission and capacity, OSTBCs, V-blast receiver, MIMO beam forming.

Unit –V — **9 Hrs**

Orthogonal Frequency Division Multiplexing: Introduction to OFDM, Multicarrier modulation, IFFT sampling for OFDM, OFDM schematic, Cyclic prefix, OFDM based parallelization, OFDM examples.

MIMO-OFDM: Introduction to MIMO-OFDM, Impact of carrier frequency offset in OFDM,

PAPR in OFDM systems, Introduction to SC-FDMA.

4G & Beyond: Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

Text Books:

1. Aditya K Jagannatham, "Principles of Modern Communication Systems - Theory andPractice," McGraw Hill Education, 2016.
2. T. S. Rappaport, "Wireless Communications - Principles and Practice," Second Edition,Pearson, 2010.
3. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.
4. Vijay Garg, “Wireless Communications and networking”, First Edition, Elsevier 2007

References:

1. David Tse and PramodViswanath, “Fundamentals of Wireless Communications”, Cambridge University Press.
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
3. EzioBiglieri, “MIMO Wireless Communications”, Cambridge University Press.
4. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE
5. for Mobile Broadband”, Second Edition, Academic Press, 2008.
6. Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011.
7. Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand various Wireless standards and their technical specifications.

CO2: Compare different propagation models.

CO3: Apply concepts of 3G/4G wireless communication systems to solve problems.

CO4: Analyze performance of various 3G/4G wireless communication systems under AWGN.

CO5: Analyze performance of various 3G/4G wireless communication systems under small-scale Fading channel conditions.

CO6: Compare different wireless technologies through performance metrics

LOW POWER VLSI DESIGN					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0450T	**3:1:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

- To impart knowledge on different abstraction levels in VLSI Design and the impact of power reduction methods at higher levels
- To describe leakage control mechanisms to reduce static power consumption in DSMVLSI regime
- To explain technology independent and technology-dependent techniques for Dynamic power reduction in CMOS circuits
- To introduce varioussoftware power estimation and optimization techniques for low power VLSI system design
- To demonstrate low power circuit and architectural techniques for reducing power consumption in SRAM designs

Syllabus	**Total Hours: 48**
Unit –I	**10 Hrs**

Introduction to Low Power design: Why worry about power – at global and SOC levels, Emerging zero-power applications (WSN), 20 nm scenario, Design-productivity challenge,Impact of implementation Choices ,Motivation for LPD ,Basic VLSI Design Flow,Optimization examples at various levels (System, Sub-system, RTL, Gate, Circuit and Device levels)Layout Design for various Transistors, Sources ofpower dissipation, MOS transistor leakage components, Static Power dissipation, Dynamic Powerdissipation, Circuit Techniques for Low Power Design–Standby leakage control using transistor stacks, Multiple VTH and dynamic VTH techniques, Supply voltage scaling technique.

Unit –II	**10 Hrs**

Power Optimization Techniques–I: Dynamic Power Reduction Approaches, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction; Leakage Power Reduction–Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques Reduction in Cache Memories, LVLP Logic Styles, Current-Mode CMOS Adders using multiple-valued logic.

Unit –III	**10 Hrs**

Power Optimization Techniques – II: Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues (Ref-2).

Software Design for Low Power: Sources of Software Power Dissipation, Software Power Estimation, Software Power Optimizations, Automated Low-Power Code Generation, Co-design for Low Power.

Unit –IV	**9 Hrs**

Low Voltage Low Power Static Random Access memories: Basics, Race between 6T and 4T memory cells, LVLP SRAM Cell designs- Shared bit-line SRAM cell configuration, Power efficient 7T SRAM cell with current mode read and write, Load less CMOS 4T SRAM cell, The 1T SRAM cell, Pre-charge and Equalization Circuit, Dynamic and static decoders, Voltage Sense amplifier, Output Latch,

Low Power SRAM Techniques: Sources of SRAM Power, Low Power Circuit techniques such as capacitance reduction, Leakage current reduction.

Unit –V	**9 Hrs**

Large LPVLSI System design and Applications: Architecture driven Voltage Scaling, Power optimization using operation reduction and operation substitution, Pre-computation based optimization, Multiple and Dynamic supplyvoltage design, Choice of supply voltages, Varying the clock speed, varying the VDD of RAM structures, Gated Clocking. Leakage current reduction in medical devices.

Text Books:

1. Kiat- Seng Yeo and Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems, Tata Mc Graw hill Edition, 2005.
2. Christian Piguet, "Low Power CMOS Circuits Technology, Logic Design and CAD Tools", 1st Indian Reprint, CRC Press, 2010.

References:

1. Kaushik Royand Sharat Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley Pub., 2000.
2. Dimitrios Soudris, Christian Piguetand Coastas Goutis, "Designing CMOS Circuits for Low Power", Kluwer Academic Pub, 2002
3. J.Rabaey, LowPowerDesignEssentials, 1stEdition, SpringerPublications, 2010.

Course Outcomes:

After the completion of the course students will able to:

CO1: Explain technology independent and technology dependent techniques for CMOS circuits.

CO2: Distinguish impact of various power reduction techniques at different levels of VLSI Design.

CO3: Identify sources of power dissipation and apply leakage reduction techniques to reduce static power consumption in CMOS circuits.

CO4: Analyze different power reduction techniques for VLSI systems at Design time, Run-time and Stand-by modes.

CO5: Apply simple software power estimation and optimization techniques for low power VLSI system design.

CO6: Apply low power circuit and architectural techniques such as capacitance reduction, gatedclocking, VDD and Vth scaling, DVS etc in digital systems and SRAM designs.

EMBEDDED REAL TIME SYSTEMS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0451T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- Develop an understanding of the technologies behind the embedded computing systems, capabilities and limitations of the hardware, software components.
- Methods to evaluate design tradeoffs between different technology choices.
- design methodologies

Syllabus	Total Hours: 48

Unit –I — **10 Hrs**

Introduction to Embedded systems: What is an embedded system Vs. General computing system, history, classification, major application areas, and purpose of embedded systems. Core of embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components.

Unit –II — **10 Hrs**

Micro controllers architecture: Characteristics, quality attributes application specific, domain specific embedded systems. Factors to be considered in selecting a controller, ARM architecture, memory organization, registers banks, special function registers, Instruction set, Thumb instruction set, source current, sinking current,8-bit and 16-bit Application Development, design examples.

Unit –III — **9 Hrs**

RTOS and Scheduling: Operating system basics, types of RTOS, tasks, process and threads, multiprocessing and multitasking, types of multitasking, non-pre-emptive, pre-emptive scheduling.

Unit –IV — **10 Hrs**

Task communication of RTOS: Shared memory, pipes, memory mapped objects, message queue, mailbox, signalling, RPC and sockets, task communication/synchronization issues, racing, deadlock. Priority Inversion semaphore, mutex, critical section objects, events, device, device drivers, how to clause an RTOS, Integration and testing of embedded hardware and firm ware.

Unit –V — **9 Hrs**

Simulators and emulators: Simulators and emulators, Debuggers, Embedded Product Development life cycle (EDLC), Trends in embedded Industry, in-circuit emulators (ICE).

Textbooks:

1. Introduction to embedded systems Shibu. K.V, TMH, 2009.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ayala &Gadre: The 8051 Microcontroller & Embedded Systems using Assembly and C, CENGAGE
2. Embedded Software Primer, David Simon, Pearson.
3. The 8051 Microcontroller and Embedded Systems, Mohammed Mazidi, Pearson,

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the basics of an embedded system and RTOS

CO2: Understand the architecture of Microcontroller and quality attributes.

CO3: Analyze the various types of Scheduling algorithms in Embedded systems RTOS.

CO4: Analyze the different types of task communication protocol to design the RTOS based embedded systems.

CO5: Describe the problems related to the RTOS for design of embedded systems.

CO6: Analyze the various tools to available to test the designed embedded system.

FUZZY SETS, LOGIC SYSTEMS AND APPLICATIONS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0452T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To provide the student with the basic understanding of fuzzy sets and logic system fundamentals.
- To understand the features of Membership functions.
- To develop the fundamental concepts such as fuzzy sets, operations and relations.
- To understand the differences between crisp and fuzzy set relations.
- To introduce fuzzy arithmetic concepts.
- To discuss fuzzy inference applications.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**
Introduction: Fuzzy sets, logic and system & Applications, introduction to real life applications of Fuzzy systems, Fuzzy sets and Fuzzy logic Toolbox in MATLAB, Membership Functions, Nomenclature terms and set theoretic operation used in Fuzzy sets- Membership functions, Nomenclature use in Fuzzy sets theory, Theoretic operation used in Fuzzy sets.	
Unit –II	**10 Hrs**
Set Theoretic operation in Fuzzy sets, Properties of Fuzzy sets- Law of Contradiction, Law of Excluded middle, Idempotency, Involution, Commutativity, Associativity, Distributivity, Absorption, Absorption of complement and Demorgan's laws. Distance between Fuzzy sets, Arithmetic operation on Fuzzy numbers- Addition, Subtraction, Multiplication and Division, complement of Fuzzy sets, T-Norm operation and S-Norm operation for Fuzzy sets.	
Unit –III	**10 Hrs**
Parameterized T-norm and S-norm operations, Crisp Relation, Fuzzy Relation, Operations on Crisp and Fuzzy relations, Projection of Fuzzy relation set, cylindrical Extension of Fuzzy sets and properties of Crisp and Fuzzy relation, Extension Principle.	
Unit –IV	**9 Hrs**
Composition of Fuzzy relations and its properties, Fuzzy tolerances equivalence relations, Linguistic, hedges, negation/complement conventions, concentration, dilation, and some examples on composite linguistic terms.	
Unit –V	**9 Hrs**
Contrast intensification of Fuzzy set Orthogonality of Fuzzy set, Fuzzy rules Fuzzy Reasoning and Fuzzy inference systems, Mamdani Fuzzy model, Example on Mamdani Fuzzy model for Single Antecedent with three rules and for Two Antecedents with four rules, Larson Fuzzy model, Tsukamoto Fuzzy model, TSK Fuzzy model	

Textbooks:

1. Ross, T. J. (2005), "Fuzzy logic with engineering applications," John Wiley & Sons.
2. J.-S. R. Jang, C.-T. Sun, and E. Mizutani, "Neuro-Fuzzy and Soft Computing" Prentice Hall.

References:

1. A First Course in Fuzzy Logic, Fourth Edition, by Hung T. Nguyen , Carol Walker , Elbert A. Walker ,CRC press.
2. Fuzzy Logic, Systems and Engineering Applications by Hubert Parks , Murphy & Moore Publishing March 8, 2022.

Course Outcomes:

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

CO1: Understand the fundamentals of fuzzy sets and logic systems.

CO2: Understand the features of Membership functions.

CO3: Analyze the fundamental concepts such as fuzzy sets, operations and relations.

CO4: Understand the differences between crisp and fuzzy set relations.

CO5: Understand the Arithmetic operations on Fuzzy numbers.

CO6: Analyze different fuzzy inference applications.

ADVANCED DIGITAL SIGNAL PROCESSING

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0453T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To understand the sampling rate conversion and summarize multirate DSP.
- To describe the various linear filtering techniques and its applications to DSP.
- To apply and estimate parametric and non-parametric power spectrum estimation.
- To acquire the knowledge on applications of multi rate digital signal processing.

Syllabus	Total Hours:48

Unit –I	10 Hrs

Multirate Digital Signal Processing: Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for Sampling-Rate Conversion, Direct-Form FIR Filter Structures, Polyphase Filter Structures, Time-Variant Filter Structures, Multistage Implementation of Sampling-Rate Conversion, Sampling-Rate Conversion of Band pass Signals, Decimation and Interpolation by Frequency Conversion, Modulation-Free Method for Decimation and Interpolation, Sampling-Rate Conversion by an Arbitrary Factor, First-Order Approximation, Second-Order Approximation (Linear Interpolation).

Unit –II	10 Hrs

Linear Prediction and Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Relationships Between the Filter Parameters and the Autocorrelation Sequence, Forward Linear Prediction, Backward Linear Prediction, The Optimum Reflection Coefficients for the Lattice Forward and Backward Predictors, Relationship of an AR Process to Linear Prediction, The Levinson-Durbin Algorithm, AR Lattice Structure, ARMA Processes and Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction, FIR Wiener Filter, IIR Wiener Filter, Noncausal Wiener Filter.

Unit –III	9 Hrs

Nonparametric Methods for Power Spectrum Estimation: Estimation of Spectra from Finite-Duration Observations of Signals, Estimation of the Autocorrelation and Power Spectrum of Random Signals, Use of the DFT in Power Spectrum Estimation, Bartlett Method, Welch Method, Blackman and Tukey Method, Performance Characteristics of Nonparametric Power Spectrum Estimators.

Unit –IV	10 Hrs

Parametric Methods for Power Spectrum Estimation: Relationships Between the Autocorrelation and the Model Parameters, The Yule-Walker Method for the AR Model Parameters, The Burg Method for the AR Model Parameters, Unconstrained Least-Squares Method for the AR Model Parameters, Sequential Estimation Methods for the AR Model Parameters, Selection of AR Model Order, MA Model for Power Spectrum Estimation, ARMA Model for Power Spectrum Estimation.

Unit –V	9 Hrs

Applications of Digital Signal Processing: Dual Tone Multi-Frequency Signal Detection, Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary Signals, Spectral Analysis of Random Signals, Musial Sound Processing, Discrete-Time Analytic Signal Generation, Sub band Coding of Speech and Audio Signals, Over Sampling A/D Converter, Over Sampling D/A Converter.

Text Books:

1. J G Proakis, D G Manolokis, "Digital Signal Processing Principles, Algorithms and Applications" 3rd Edition, Prentice Hall.
2. Sanjit K Mitra, "Digital Signal Processing – A Computer Based Approach", 2nd Edition, Tata Mc graw Hill Publications.

References:

1. A V Oppenhiem, R W Schafer, "Discrete-Time Signal Processing", Pearson Education.
2. S. M .Kay, "Modern spectral Estimation Techniques" PHI, 1997.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the sampling rate conversion, interpolation and decimation for signal processing applications also need of optimum linear filtering and its applications.

CO2: Apply and explore the real-time applications to multirate DSP systems.

CO3: Analyze the parametric and non-parametric methods for power spectrum estimation.

CO4: Describe the applications of DSP to real-time requirements.

CO5: Solve the linear equations and analyze the optimum filters to estimate the signals corrupted by noise.

CO6: Differentiate parametric and non-parametric methods for power spectrum estimation.

INTERNET OF THINGS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A04054T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols.
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Syllabus	Total hours:48
Unit –I	**10 Hrs**

Fundamentals of IoT: Definition & Characteristics of IoT, Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects Logical Design of IoT – IoT, Functional Blocks, Security.

Unit –II	10 Hrs

Communication Protocols for IoT: Working principles of sensors – IOT deployment for Raspberry Pi /Arduino/Equivalent platform – Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, WIFI and USB - Contiki OS- Cooja Simulator. Communication modules – Bluetooth – Zigbee – WIFI – GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..), MQTT, Wired Communication, Power Sources

Unit –III	10 Hrs

Design and development : Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

Unit –IV	9 Hrs

Data acquisition and supporting services : Data Acquisition with Python and Tkinter: Basics- CSV file, Storing Arduino data with CSV file, Connecting to the Cloud: Smart IoT Systems - Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning , Smart Motion Detector and Upload Image to gmail.com

Unit –V	9 Hrs

Applications of IoT: Applications of IoT, Business models for IoT, Green energy buildings and infrastructure, Smart farming, Smart retailing and Smart fleet management, Recent trends, Internet of Medical Things (IoMT), Proposed Model, Result and Discussion, Applications for smart cities.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Qusay F. Hassan, Internet of Things A to Z, IEEE Press

References:

1. Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.
2. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, Internet of Things with Raspberry Pi and Arduino, CRC Press, 2019.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).

E-learning resources:

1. https://www.guru99.com/iot-tutorial.html
2. https://developer.ibm.com/technologies/iot/tutorials/

Course Outcomes:

After the completion of the course students will able to:

CO1: Explain the concept of IoT.

CO2: Analyze various protocols for IoT.

CO3: Design a PoC of an IoT system using Rasperry Pi/Arduino

CO4: Apply data acquisition and use cloud offerings related to IoT.

CO5: Analyze applications of IoT in real time scenario.

CO6: Apply the knowledge of IOT in various areas of engineering field.

CPLD & FPGA ARCHITECTURE AND APPLICATIONS					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0455T	**3:0:0**	**3**	**CIE:30** **SEE:70**	**3 Hours**	**PEC**

Course Objectives:

- To understand the concepts of Programmable Logic Devices & Complex Programmable Logic Devices
- To give exposure to understand the concept of Field Programmable Gate Arrays design.
- To give exposure to understand the concept of Field Programmable Gate Arrays Case Studies.
- The Students aims to practical experience by designing of Finite State Machines
- To provide students with the understanding of the different FSM Architecture & System level Design.

Syllabus	**Total Hours: 48**
Unit –I:: Introduction to Complex Programmable Logic Devices	**10 Hrs**

Programmable Logic: ROM, PLA, PAL, PLD, FPGA – Features

Complex Programmable Logic Devices: ALTERA CPLDs and ALTERA FLEX 10k Series CPLD, Speed Performance.

Unit –II:: Field Programmable Gate Arrays	**10 Hrs**

Xilinx logic Cell array, CLB, I/O Block Programmable interconnect, Technology Mapping for FPGA: Library based, LUT based, Multiplexer based Technology Mapping.

Unit –III:: FPGA Case Studies	**10 Hrs**

Case Studies: programming Technologies, Xilinx XC3000, XC4000, Actel FPGAs, Alteras FPGAs, Plus Logic FPGA, AMD FPGA, Quick Logic FPGA, Algotronix FPGA, Cross point solutions FPGA, FPGA Design Flow.

Unit –IV:: Finite State Machines (FSM)	**9 Hrs**

Finite State Machines (FSM): Finite State Machine– State Transition Table, State Assignments for FPGAs. Problem of the Initial State Assignment for One Hot Encoding.

Realization of State Machine: Derivation of SM Charts. Realization of State Machine Chart, Alternative Realization of State Machine Chart using Microprogramming. Linked State Machines. One–Hot State Machine, Petri nets for State Machines – Basic Concepts, Properties. Extended Petri nets for Parallel Controllers.

Unit –V:: FSM Architectures & Systems Level Design	**9 Hrs**

FSM Architectures: Architectures Centered Around Non- Registered PLDs. State Machine Designs Centered Around A Shift Register.

Systems Level Design: One–Hot Design Method. Use of ASMs in One–Hot Design. Application of One–Hot Method. System Level Design: Controller, Data Path and Functional Partition.

Text Books:

1. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte), 1994.
2. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.

References:

1. Fundamentals of logic Design, 5/e, Charles H Roth.Jr.
2. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin

Course Outcomes:

After the completion of the course students will able to:

CO1: Acquire qualitative knowledge about the PLD's & CPLD's.

CO2: Understand the concept of Field Programmable Gate Arrays design.

CO3: Apply the basic FPGA Case Studies in different Module design.

CO4: Understand the different Modules of Finite State Machine.

CO5: Understand the Architecture of Finite State Machine.

CO6: Acquire qualitative knowledge about realization of Finite State Machine.

DIGITAL IMAGE PROCESSING (Common to ECE and CSE)					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0456T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course is designed to enable the students to familiarize themselves with basic concepts of digital image processing and different image transforms and learn various image processing techniques like image enhancement, restoration, segmentation and compression

Syllabus		**Total Hours: 48**
Unit –I	Basics to Image Processing	**10 Hrs**

Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2- D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

Unit-II	**Intensity Transformations and Filtering**	**10 Hrs**

Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods.

Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

Unit-III	**Image Restoration and Reconstruction**	**10 Hrs**

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter ,image reconstruction from projections.

Unit-IV	**Image compression**	**9 Hrs**

Image compression: Fundamentals and Basic compression methods, Lossy and Lossless compression techniques (Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding).

Wavelets and Multi resolution Processing: Image pyramids, sub band coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

Unit-V	Image segmentation	9 Hrs

Image segmentation: Fundamentals, point, line, edge detection, thresholding, and region –based segmentation.

Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

Course Outcomes (CO):

After the completion of the course students will able to:

CO1: Understand various image transform techniques.

CO2: Understand image manipulations and different digital image processing techniques.

CO3: Understand basic operations like – Enhancement, segmentation, compression, Image transforms.

CO4: Classify Image transforms and restoration techniques on image.

CO5: Analyze pseudo and full color image processing techniques.

CO6: Apply various morphological operators on images.

DIGITAL TV ENGINEERING

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0457T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To teach knowledge on Digital television standards
- To impart information on the channel coding for digital TV
- To teach different transmitters for digital television& its control.
- To provide the awareness of the transmission lines, testing & measurement of power for Digital TV

Syllabus	Total Hours: 48

Unit –I — **10 Hrs**

Digital Television Transmission Standards: ATSC terrestrial transmission standard, vestigial side band modulation, DVB- T transmission standard, ISDB-T transmission standard, channel allocations, antenna height and power, MPEG-2 Performance Objectives for Digital Television: System noise, external noise sources, transmission errors, error vector magnitude, eye pattern, interference, co-channel interference, adjacent channel interference, analog to digital TV, transmitter requirements

Unit –II — **10 Hrs**

Channel Coding and Modulation for Digital Television: Data synchronization, randomization/ scrambling, forward error correction, interleaving, inner code, frame sync insertion, quadrature modulation,8VSB, bandwidth, error rate, COFDM, flexibility, bandwidth.

Unit –III — **9 Hrs**

Transmitters for Digital Television: Pre-correction and equalization, up conversion, precise frequency control, RF amplifiers, solid-state transmitters, RF amplifier modules, power supplies, cooling, automatic gain or level control, ac distribution, transmitter control, tube transmitters, performance equality.

Unit –IV — **10 Hrs**

Transmission Line for Digital Television: Fundamental parameters, efficiency, effect of VSWR, system AERP, rigid coaxial transmission lines, dissipation, attenuation, and power handling, higher-order modes, peak power rating, frequency response, standard lengths, corrugated coaxial cables, wind load, waveguide, bandwidth, waveguide attenuation, power rating, frequency response, size trade-offs, wave guide or coax Pressurization

Unit –V — **9 Hrs**

Test and Measurement for Digital Television: Power measurements, average power measurement, calorimetry, power meters, peak power measurement, measurement uncertainty, testing digital television transmitters.

Text Books:

1. Gerald w. Collins, Fundamentals of Digital Television Transmission, JohnWiley, 2001.
2. R.R. Gulati, Modern Television Practice, Principles, Technology and servicing, 2nd Ed., New Age International Publishers, 2001.

References:

1. John Arnold, Michael Frater, Mark Pickering, Digital Television Technology and Standards, JohnWiley, 2007.

e-resources:

1. https://www.youtube.com/watch?v=_nGnRvyHMEI HYPERLINK
2. "https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2"& HYPERLINK
3. "https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2"list=RDCMUCdlnqMpRrMcClK2fT HYPERLINK
4. "https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2"6z8EEw HYPERLINK
5. "https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2"& HYPERLINK
6. "https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2"index=2
7. https://www.rfwireless-world.com/Tutorials/digital-television-DTV-basics.html

Course Outcomes:

After the completion of the course students will able to:

CO1: Compare Digital TV transmission standards and performance parameters

CO2: Analyze channel coding, errors, interferences

CO3: Analyze various modulation techniques for Digital TV

CO4: Make use of RF amplifiers, modules and systems for Digital TV

CO5: Apply Transmission line principles for Digital TV

CO6: Understand the measurement parameters for a Digital TV Transmitter

CLOUD COMPUTING (Common to CE,EEE,ME and ECE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0529T	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and familiar with the lead players in cloud.
- To understand the features of cloud simulator and apply different cloud programming model
- To design of cloud Services and explore the trusted cloud Computing system

Syllabus		**Total Hours:48**
Unit -I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Unit -II	**Cloud Architecture, Models and Security**	**9Hrs**

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.

Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Unit -III	**Cloud Technologies and Advancements**	**10Hrs**

Apache Hadoop, Map Reduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Unit -IV	**VM ware Simulator**	**9Hrs**

VM Ware: Basics of VM Ware, Advantages of VMware virtualization, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Unit -V	**Cloud Applications**	**10Hrs**

Cloud Applications: Scientific Applications – Health Care, Geoscience.

Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications, and Multiplayer Online Gaming.

Text Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010.

Reference Books:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.
5. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.

Web Resources:

1. https://nptel.ac.in/courses
2. https://freevideolectures.com/university/iitm

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the basic concepts about cloud computing vision and its developments and gain the Knowledge of virtualization technology.

CO2: Analyze the concepts of cloud services and the deployment models.

CO3: Choose among various cloud technologies for implementing applications (GAE, Open stack, etc)

CO4: Construct the virtual machines by using VMware simulator.

CO5: Build scientific applications by using Cloud environment.

CO6: Develop Business and Consumer Applications.

SMART GRID (Common to all Except EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0241Ta	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies.

Syllabus		**Total Hours: 48**
Unit-I	**Introduction to Smart Grid**	**10 Hrs**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Unit-II	**Smart Grid Technologies**	**8 Hrs**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

Unit –III	**Smart Meters**	**10 Hrs**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

Unit -IV	**Power Quality Management in Smart Grid**	**10 Hrs**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit –V	**High Performance Computing**	**10 Hrs**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Textbooks:

1. Smart Grid, JanakaEkanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. 2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the concepts and design of Smart grid.

CO2: Understand the various communication technologies in smart grid.

CO3: Understand the various measurement technologies in smart grid.

CO4: Understand the analysis and stability of smart grid.

CO5: Learn the renewable energy resources and storages integrated with smart grid.

CO6: Familiarize the high performance computing for Smart Grid applications

MEASUREMENTS AND MECHATRONICS					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0330Ta	**2: 1:0 :3**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- To instruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Syllabus		**Total Hours: 48**
UNIT-I	**Limits & Fits**	**10 Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

UNIT-II	**Linear and Angular Measurements**	**10 Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

UNIT-III	**Mechanical Measurements**	**9 Hrs**

Introduction to measurement: Elements of generalized measurement system

Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)

Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge

UNIT-IV	**Mechatronics Systems**	**9 Hrs**

Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems

UNIT-V	**Actuating Systems:**	**10Hrs**

Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition,PHI / PE.
3. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and
4. Electrical Engg.", 4th Edition, Pearson, 2012.

Reference Books:

1. 1. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
2. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Design the limit gauges for interchangeable manufacture.

CO2: Apply the basic principles of mechanical measurements for engineering practice.

CO3: Illustrate the role of mechatronics systems in manufacturing.

CO4: Explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

CO5: Understand the components of a typical mechatronic system.

CO6: Understand the Design Aspects of a Mechatronic system.

DISASTER MANGEMENT

(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0151T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations.
- Describe the three planning strategies useful in mitigation.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management

Syllabus		Total Hours:48
Unit-I	**Natural Hazards and Disaster Management**	**9 Hrs**
Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides		
Unit-II	**Man Made Disaster**	**9 Hrs**
Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.		
Unit -III	**Risk and Vulnerability**	**10 Hrs**
Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.		
Unit -IV	**Role of Technology in Disaster Managements**	**10 Hrs**
Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.		
Unit -V	**Education and Community Preparedness**	**10 Hrs**
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.		

Textbooks:

1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges and Local Solutions' Universities press. (2009),
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi

Reference Books:

1. Harsh. K . Gupta "Disaster Management edited", Universities press, 2003.

E-resources:

1. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Know about the natural hazards and its management

CO2: Know about the fire hazards and solid waste management

CO3: Understand about the emerging infectious diseases and aids their management

CO4: Know about the regulations of building codes and land use planning related to risk and vulnerability.

CO5: Impart the education related to risk reduction in schools and communities.

CO6: Describe public awareness and economic incentive possibilities.

CYBER SECURITY
(Common to CE,EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534b	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.
- Evaluate the trends and patterns that will determine the future state of cyber security.

Syllabus		Total Hours:48
Unit -I	**Introduction to Cybercrime**	**9 Hrs**

Introduction to Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens

Unit -II	**Cyber Offenses**	**10 Hrs**

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Backdoors-Steganography-SQL Injection.

Unit -III	**Cybercrime Mobile and Wireless Devices**	**9 Hrs**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile.

Unit -IV	**Tools and Methods Used in Cybercrime**	**10Hrs**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, DoS and DDoS Attacks, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Unit -V	**Cyber Crimes and Security**	**10Hrs**

Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning

Reference Books:

1. Information Security, Mark Rhodes, Ousley, MGH.

E-resources:

1. https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm
2. https://www.javatpoint.com/cyber-security-tutorial
3. https://www.youtube.com/watch?v=lpa8uy4DyMo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI4_

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand Cyber Security architecture principles

CO2: Identifying System and application security threats and vulnerabilities

CO3: Identifying different classes of attacks

CO4: Cyber Security incidents to apply appropriate response

CO5: Describing risk management processes and practices

CO6: Demonstrate the role security management in cyber security defense

RENEWABLE ENERGY SOURCES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0327Ta	**2: 1:0 :3**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To impart knowledge on non-conventional sources of energy and techniques used in exploiting solar, wind, tidal and geothermal sources of energy and Biomass.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

Syllabus		**Total Hours:47**
UNIT-I	**Energy Sources and Their Availability**	**10Hrs**

Energy Sources and Their Availability: Conventional and non-conventional energy sources. Need of Renewable Energy Sources (RES), classification of RES, role and potential of RES in India.

Solar Radiation: Structure of the sun, solar constant, environmental impact of solar radiation, radiation at the earth surfaces, solar radiation measuring instruments, solar radiation Geometry, extraterrestrial and terrestrial solar radiation, spectral distribution of extraterrestrial radiation, solar radiation on tilted surfaces and empirical equations for estimating solar radiation.

UNIT-II	**Solar Collectors**	**9Hrs**

Solar Collectors: Principles of the conversion of solar radiation into heat, classifications of solar collectors- flat plate collectors and concentrating collectors, collector materials, performance analysis of a flat plate collector.

Solar Energy Storage and applications: Different storage methods-sensible and latent heat, solar ponds, solar water heating, space heating /cooling, solar electric conversion, solar distillation, solar pumping, solar furnace, solar cooking and solar green house.

UNIT-III	**Wind Energy**	**10Hrs**

Wind Energy: Principles of wind energy conversion, site selection consideration, basic components, types of wind machines – horizontal axis and vertical axis, applications, Betz coefficient.

Biomass Energy Conversion Systems: Biomass conversion technologies, photosynthesis, biogas generation, factors affecting bio-digestion, classification of biogas plants, advantages and disadvantages, bio mass gasification

Geothermal Thermal Energy: Resources, types of wells, methods of harnessing the energy.

UNIT-IV	**Ocean Thermal Energy**	**9Hrs**

Ocean Thermal Energy: Methods of Ocean thermal electric power generation open cycle systems, closed cycle systems

Tidal Power System: Working principle, components of tidal power plant, single basin and double basin tidal energy system advantages and limitations.

Wave Energy: Wave energy conversion Devices-wave energy conversion by floats, high level reservoir wave machine and dolphin type wave power machine. Advantages and disadvantages.

UNIT-V	**Direct Energy Conversion**	**9Hrs**

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. thermoelectric Power – See-beck, Peltier, Joule -Thomson effects, Thermo-electric Power generators

MHD Power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion.

Fuel Cell: Working principle, classification – efficiency – VI characteristics

Text Books:

1. SP Sukhatme, “Solar Energy: Principles of thermal collection and storage” Tata McGraw Hill
2. Tiwari and Ghosal, “Renewable Energy Resources: Basic Principles and Applications”, narosa
3. G.D. Rai, “Non-Conventional Energy Sources”, Dhanpat Rai and Sons

Reference Books:

1. B.H.Khan, “Non – conventional Energy Resources”, Tata McGraw Hill education Pvt. Ltd.
2. 2. Twidell& Weir, “Renewable Energy Sources “. Routledge (Taylor &Francis Group)

Course Outcomes(CO):

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

CO1: Classify various types of renewable sources of energy and illustrate the principles of solar radiation.

CO2: Evaluate solar flat plate collector efficiency and illustrate various solar energy storage methods and applications.

CO3: Describe the techniques of exploiting wind, biomass and geothermal energies in power generation.

CO4: Illustrate the methods of tapping ocean thermal, tidal and wave energies in power generation.

CO5: Describe the working of various direct energy conversion systems and their applications. Cyber Security incidents to apply appropriate response

CO6: Describing risk management processes and practices

CONSTRUCTION MANAGEMENT
(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0152T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To make the student familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of construction activities
- To make the students familiar with concepts involved in project management like bar charts and milestone charts
- To teach the students the concepts of time estimates involved in CPM and PERT , float and slack, critical path calculations

Syllabus		Total Hours:48
Unit-I	**Fundamentals of Construction Technology**	**9 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

Unit-II	Earth Work	9 Hrs

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging.Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

Unit -III	Project Management , Bar Charts and Milestone Charts	10 Hrs

Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts

Unit -IV	Elements of Network and Development of Network	10 Hrs

Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems.

Unit -V	PERT and CPM	10 Hrs

Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems -Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems. Introduction - Slack – Critical path-Illustrative examples Problems.

Textbooks:

1. Construction project management by Jha ,Pearsonpublications, New Delhi 2nd Edition 2015
2. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher EducationUniv.Press, Delhi 2008 edition
3. 3. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 editionDelhi

Reference Books:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by: P.K.JOY- Mac Millan Publishers India Limited.

E-resources:

1. https://nptel.ac.in/courses/105104161

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Identify the various construction activities like preparing construction schedule an maintaining documents and records of those activities

CO2: Understand the concepts and techniques involved in earthwork activities

CO3: Understand about the emerging infectious diseases and aids their management

CO4: Understand the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts.

CO5: Understand the various elements of a network diagram like event, activity and dummy.

CO6: Understand the concepts of calculation of time estimates of CPM and PERT

ELECTRIC VEHICLES (Common to all Except EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0232Ta	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- Understand to provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Syllabus		**Total Hours: 50**
Unit-I	**Electric Vehicle Propulsion and Energy Sources**	**10 Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Unit-II	**Electric Vehicle Power Plant And Drives**	**10 Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Unit -III	**Hybrid and Electric Drive Trains**	**9 Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Unit -IV	**Electric and Hybrid Vehicles - Case Studies**	**11 Hrs**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

Unit -V	**Electric and Hybrid Vehicle Design**	**10 Hrs**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Textbooks:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

Reference Books:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the working of hybrid and electric vehicles

CO2: Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources

CO3: Develop the electric propulsion unit and its control for application of electric vehicles.

CO4: Understand the proper energy storage systems for vehicle applications

CO5: Design and develop basic schemes of electric vehicles

CO6: Design and develop basic schemes of Hybrid electric vehicles

ARTIFICIAL INTELLIGENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A3301T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To understand the importance of the task environment in determining the appropriate agent design.
- To teach the concepts of state space representation, heuristic search together with the time and Space complexities.
- To describe the various types of learning methods and natural language processing.
- To provide basic knowledge on natural language for communication and perception.
- To understand the basic knowledge on robotics and philosophical foundations of AI.

Syllabus		**Total Hours: 45**
Unit-I	**Introduction to Artificial Intelligence**	**9 Hrs**

Introduction: AI Definition, Foundations of Artificial Intelligence, History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Good Behavior Concept of Rationality, Nature of Environments, The Structure of Agents. Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, DFS: Informed (Heuristic) Search strategies: Greedy BFS, A* search.

Unit-II	**Problem Solving beyond classical search and Learning**	**9 Hrs**

Local search algorithms and optimization problems**:** Hill-climbing, simulated annealing; Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with partial observations, Online Search Agents and Unknown Environment.

Unit -III	**Reinforcement Learning and Natural Language Processing**	**9 Hrs**

Introduction, Passive Reinforcement Learning, Active reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of Reinforcement Learning**,** Language Models, Text Classification, Information Retrieval, Information Extraction.

Unit -IV	**Natural Language for communication and Perception**	**9 Hrs**

Phrase structure grammars, Syntactic analysis, Augmented grammars and semantic Interpretation, Machine translation, Speech Recognition. Image formation, Early Image Processing Operations, Object recognition by appearance, Reconstructing the 3D World, Object recognition from structural information, Using Vision**.**

Unit -V	**Robotics and Philosophical foundations**	**9 Hrs**

Introduction, Robotic Hardware, Robotic Perception, Planning to move, Planning uncertain movements, Moving, Robotic software architectures, and application domains.Week AI, Strong AI, Ethics and Risks of AI, Agent Components and Agent architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, 3rdEdition, Pearson Education.
2. Elaine Rich, Kevin Knight & Shivashankar B Nair, “Artificial Intelligence”, 3rd - Edition, McGraw Hill Education.

Reference Books:

1. Patrick Henny Winston, Artificial Intelligence, 3rdEdition, Pearson Education.
2. Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition Pearson India.
3. George F Lugar, Artificial intelligence, structures and Strategies for Complex problem solving,6thed, PEA, 2008 .
4. Poole, D. and Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press. 2010
5. Padhy, N.P , Artificial Intelligence and Intelligent Systems,. 2009, Oxford University Press.

E-resources:

1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.youtube.com/watch?v=JMUxmLyrhSk

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the role of agents, environments and relationship among them.
CO2: Examine various problem-solving approaches in searching and learning.
CO3: Demonstrate the use of Reinforcement learning and natural language processing.
CO4: Understand the natural language for communication and object perception.
CO5: Demonstrate the role of Robot in various applications**.**
CO6: List out philosophical issues in AI.

ENTREPRENEURSHIP & INNOVATION					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0024T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/women entrepreneurs
- To encourage the student in creating and designing business plans

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Entrepreneurship**	**10Hrs**

Entrepreneurship-Concept, knowledge and skills requirement-Characteristics of successful entrepreneurs-Entrepreneurship process- Factors impacting emergence of entrepreneurship-Differences between Entrepreneur and Intrapreneur- Understanding individual entrepreneurial mindset and personality-Recent trends in Entrepreneurship.

Unit -II	**Starting Up New Venture**	**10Hrs**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas- Opportunity recognition- Feasibility study-Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report – Presenting business plan to investors.

Unit -III	**Sources of Finanace**	**9 Hrs**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India – their way of financing in India for small and medium business -Entrepreneurship development programs in India – The entrepreneurial journey- Institutions in aid of entrepreneurship development

Unit -IV	**Women Entrepreneurship**	**9 Hrs**

Women Entrepreneurship- Entrepreneurship Development and Government-Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available – Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India-Issues & Challenges-Entrepreneurial motivations.

Unit -V	**Introduction to Incubation & Innovation**	**10 Hrs**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation. Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Text books:

1. D F Kurat koand TV Rao, "Entrepreneurship"- A South- Asian Perspective Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit:login.cengage.com)
2. Nandan H, "Fundamentals of Entrepreneurship" ,PHI, 2013

Reference Books:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", HimalayaPublishing2012.
2. RajeevRoy"Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwana"EntrepreneurshipDevelopment: Text&Cases", ExcelBooks, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the concept of Entrepreneurship and challenges in the world of competition.

CO2: Apply the Knowledge in generating ideas for New Ventures.

CO3: Analyze various sources of finance and subsidies to entrepreneur/ women Entrepreneurs.

CO4: Evaluate the role of central government and state government in promoting entrepreneurship.

CO5: Analyze the process of business incubation/incubators.

CO6: Create and design business plan structure through incubations.

MANAGEMENT SCIENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0023T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training& Development, job evaluation and Merit rating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in management.

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Management**	**10Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles -Eltan Mayo's Human relations - Systems Theory - Organisational Designs - Line organization - Line&StaffOrganization-FunctionalOrganization-MatrixOrganization-Projectorganization-CommitteeformofOrganization-SocialresponsibilitiesofManagement.

Unit -II	**Operations Management**	**10Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),Work Study- Statistical Quality Control-Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, T Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept - Meaning-Nature-FunctionsofMarketing-MarketingMix-ChannelsofDistribution-AdvertisementandSalesPromotion-MarketingStrategiesbasedonProductLifeCycle.

Unit -III	**Human Resources Management**	**10Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP)- Employee Recruitment-Sources of Recruitment-Employee Selection -Process and Tests in Employee Selection -EmployeeTrainingandDevelopment-On-the-job&Off-the-jobtrainingmethods-PerformanceAppraisal Concept- Methods of Performance Appraisal – Placement- Employee Induction –Wage and Salary Administration.

Unit -IV	**Strategic & Project Management**	**10Hrs**

Definition &Meaning-Setting of Vision -Mission -Goals –Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - ProjectManagement-NetworkAnalysis-ProgrammeEvaluationandReviewTechnique(PERT) - Critical Path Method (CPM)Identifying Critical Path - Probability of Completing theprojectwithingiventime-ProjectCost-Analysis-ProjectCrashing(Simpleproblems).

Unit -V	Contemporary Issues in Management	8Hrs

The concept of ManagementInformationSystem(MIS)-MaterialsRequirementPlanning(MRP)-Customer Relations Management(CRM)-Total Quality Management (TQM)-Six Sigma Concept-Supply Chain Management (SCM)-Enterprise Resource Planning (ERP)- Performance Management-Business Process Outsourcing (BPO) –Business Process Re-engineering and Bench Marking-Balanced Score Card-Knowledge Management.

Textbooks:

1. A.RAryasri,"ManagementScience",TMH,2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education,NewDelhi,2012.

Reference Books:

1. Koontz&Weihrich,"EssentialsofManagement",6th edition,TMH,2005.
2. ThomasN.Duening&JohnM.Ivancevich,"ManagementPrinciplesandGuidelines",Biztantra.
3. KanishkaBedi,"ProductionandOperationsManagement",OxfordUniversityPress,2004.
4. SamuelC.Certo,"ModernManagement",9th edition,PHI,2005

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the concepts & principles of management and designs of organization in a practical world

CO2: Apply the knowledge of Work –study principles& Quality Control techniques in industry

CO3: Analyze the concepts of HRM in Recruitment, Selection and Training&Development

CO4: Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time& cost of project

CO5: Analyze the business through SWOT

CO6: Create Modern technology in management science.

BUSINESS ENVIRONMENT					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0026T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To make the student understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.
- To facilitate them in understanding the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- Encourage the student in knowing the structure of stock market.

Syllabus		**Total Hours:48**
Unit -I	**An Overview of Business Environment**	**10Hrs**

Overview of Business Environment – Types of Environments - Internal & External –Micro and Macro environment- Competitive structure of industries - Environmental analysis - Scopeofbusiness-Characteristicsofbusiness-Process&limitationsofenvironmentalanalysis.

Unit -II	**Fiscal policy & Monetary Policy**	**10 Hrs**

FISCALPOLICY-PublicRevenues-PublicExpenditure-PublicdebtDevelopmentactivities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI - Objectivesofmonetaryandcreditpolicy-Recenttrends-RoleofFinanceCommission.

Unit -III	**India's Trade Policy & Balance of payments**	**10Hrs**

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade – Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OFPAYMENTS–Structure&Majorcomponents-CausesforDisequilibriuminBalanceofPayments-Correctionmeasures–WTO - Nature and Scope - Organization and Structure – Role and functions of WTO in promoting world trade

Unit -IV	**Money markets and capital markets**	**10Hrs**

Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.

Unit -V	**Introduction to Inflation**	**8hrs**

Inflation – Meaning & Definition – Causes – Effects – Types – Advantages &Disadvantages Deflation – Meaning & Definition - Causes & Effects.

Textbooks:

1. Francis Cherunilam (2009), "International Business":Text and Cases, Prentice Hall of India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH2016.

Reference Books:

1. K.V. Sivayya, V.B.M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, NewDelhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari .S.N (2009),International Business, Wiley India.
4. E. Bhattacharya(2009),InternationalBusiness,ExcelPublications,NewDelhi.

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand various types of business environment.

CO2: Evaluate fiscal and monitory policy

CO3: Analyze India's Trade Policy

CO4: Understand the role of WTO

CO5: Apply the knowledge of Money markets in future investment

CO6: Develop a personal synthesis and approach for identifying business opportunities

HUMAN RESOURCE MANAGEMENT					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0033T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To make the student understand about human resource management.
- To enable the students about job analysis, job specification and job enrichment.
- To enable the students knowing about HR planning and retention.
- To impact knowledge about recruitment, selection and performance appraisal.
- To create knowledge on training and development, compensation management.

Syllabus		**Total Hours:48**
Unit - I	**Human Resource Management-Introduction**	**9 Hrs**

Introduction- Objectives – Scope & Features of HRM – Importance & - Functions of HRM- Challenges of HRM. Personnel Management Vs HRM – Role of HR manager - Strategic Human Resource Management.

Unit - II	**Job Analysis and Job Design**	**9 Hrs**

Job Analysis Process –Techniques of Data Collection - Contents of Job Description & Job Specification - Job design - Factors affecting Job design - Job enrichment Vs Job enlargement.

Unit - III	**Human Resource Planning and Employee Retention**	**10 Hrs**

Objectives and Need of HR planning, Process of HR Planning and factors affect the HR Planning -HR Information System - Employee retention - Importance of retention - strategies of retention.

Unit - IV	**HR Acquisition and Managing Employee Performance**	**10 Hrs**

Recruitment - Objectives and Sources of recruitment - Selection - Objectives - Selection Procedure - Placement - Performance Appraisal –Objectives & Importance, performance Appraisal Methods – Constraints.

Unit - V	**HR Development and Compensation Management**	**9 Hrs**

Training and Development– Objectives, Need and Methods of Training –career planning and career development - Compensation Management - Job evaluation – welfare provisions and fringe benefits - Quality Circles and Total Quality Management.

Textbooks:

1. Gary Dessler, Biju Varkkey, Human Resource Management, 4e, Pearson 2017.
2. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human ResourceManagement, Cengage Learning 2016.

Reference Books:

1. Aswathappa, Human Resource Management, 4th Edition, TMH 2006.
2. Subbarao, Personnel and Human Resource Management –Text and cases,Himalaya, 2009
3. R.Wayne Mondy, Robert M.Noe, Human Resource Management, Pearson
4. Noea.Raymond, John Hollenbeck, Barry Gerhart and Patrick Wright, HumanResource Management, Tata McGraw Hill.
5. Muller, Human Resource Management a case study approach, Jaico Publishers,2008
6. VSP Rao, Human Resource Management, Text and Cases, Excel Books 2006.

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Understand the basic concept of Human Resource Management

CO2: Explain the job analysis and job design methods

CO3: Understand the demand and supply of HR & concept of employee retention

CO4: Understand the sources of Recruitment, Selection process and Performance appraisal methods

CO5: Examine the Training and Development methods and compensation managementprocess.

CO6: Familiarize the students with the contemporary issues in Management

MOBILE APPLICATION DEVELOPMENT

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A04058P	1:0:0	2	CIE:30 SEE:70	3 Hours	SC

Course Objectives:

- To facilitate students to understand android SDK.
- To help students to gain a basic understanding of Android application development.
- To build the working knowledge of Android Studio development tool.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	
Unit –II	**10 Hrs**
Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	
Unit –III	**10 Hrs**
Android User Interface Design Essentials: User Interface Screen elements, Designing User Inter faces with Layouts, Drawing and Working with Animation.	
Unit –IV	**9 Hrs**
Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.	
Unit –V	**9 Hrs**
Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	

Text Books:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

References:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

E-learning resources:

1. https://developer.android.com/

Course Outcomes:

After the completion of the course students will able to:

CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms.

CO2: Create and Run Android project using SDK.

CO3: Develop first level Android applications that can accept information from the users.

CO4: Design Android application screen with various elements for improving users experience.

CO5: Utilize various Android API's for improving users experience.

CO6: Understand simple GUI applications, use built-in widgets and components, work with the database to store data locally.

COURSES OFFERED FOR HONOR DEGREE BY ECE

1. The Honor subjects are having a total of 20 additional credits.

2. Students should acquire 4 credits through MOOCs compulsorily to award the Honor Degree.

Sl. No.	Course Code	Name of the Honor Course	Hours per week			Credits
			L	T	P	C
1	22A04H01	Low Power VLSI Circuits and Systems	3	1	0	4
2	22A04H02	Pattern Recognition	3	1	0	4
3	22A04H03	Software Defined Radio	3	1	0	4
4	22A04H04	Micro Electro Mechanical Systems	3	1	0	4
5	22A04H05	Wireless Communications	3	1	0	4
6	22A04H06	VLSI Testing and Testability	3	1	0	4
7	22A04H07	ARM based Embedded System Design	3	1	0	4
8	22A04H08	Semiconductor Device Modelling	3	1	0	4
9	22A04109	Modern Digital Communication Techniques	3	1	0	4
10	22A04110	VLSI Interconnects	3	1	0	4

LOW POWER VLSI CIRCUITS AND SYSTEMS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A04H01	3:0:0	4	CIE:30 SEE:70	3 Hours	HONOR

Course Objectives:

- Understand the concepts of Low power VLSI circuits and systems and Electrical characteristics of MOS Transistors
- Understand the characteristics MOS Inverters and MOS Combinational Circuits.
- Students can learn the various sources and voltage scaling techniques to design the low power VLSI circuits.
- To understand the leakage power minimization techniques.

Syllabus	Total Hours:48
Unit –I	**10 Hrs**

Introduction, Historical background, why low power, sources of power dissipations, low-power design methodologies.

MOS Transistors: introduction, the structure of MOS Transistor, the Fluid model, Modes of operation of MOS Transistor, Electrical characteristics of MOS Transistors, MOS Transistors as a switch.

Unit –II	**10 Hrs**

MOS Inverters: introduction, inverter and its characteristics, configurations, inverter ratio in different situations, switching characteristics, delay parameters, driving large capacitive loads.

MOS Combinational Circuits: introduction, Pass-Transistor logic, Gate logic, MOS Dynamic Circuits.

Unit –III	**10 Hrs**

Sources of Power Dissipation: introduction, short-circuit power dissipation, switching power dissipation, Glitching power dissipation, leakage power dissipation.

Supply voltage scaling for low power: introduction, device features size scaling, architecture-level approaches, Voltage Scaling Using High-Level Transformations, multilevel voltage scaling, Challenges in MVS, dynamic voltage and frequency scaling, adaptive voltage scaling, Sub threshold Logic Circuits.

Unit –IV	**9 Hrs**

Minimizing Switched Capacitance: introduction, system-level approaches, transmeta's Crusoe processor, bus encoding, clock gating, gated-clock FSMs, FSM state encoding, FSM Partitioning, operand isolation, precomputation, Glitching Power Minimization, logic styles for low power.

Unit –V	**9 Hrs**

Minimizing Leakage Power: introduction, fabrication of multiple threshold voltages, VTCMOS Approach, Transistor Stacking, MTCMOS Approach, Adiabatic Logic Circuits, Battery-Driven System, Low-Power Software Approaches.

Text Books:

1. Ajit. Pal, Low power VLSI Circuits and systems, springer
2. Sung Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata Mcgrag Hill.
3. Neil H. E. Weste and K. Eshraghian, Principles of CMOS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint).
4. A. Bellamour, and M. I. Elmasri, Low Power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995.
5. Anantha P. Chandrakasan and Robert W. Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.

References:

1. Kaushik Roy and Sharat C. Prasad, Low-Power CMOS VLSI Design, Wiley-Interscience, 2000.

Course Outcomes:

After the completion of the course students will able to:

CO1: Explain the structure, fluid model and Electrical characteristics of MOS transistors.

CO2: Explain the concepts of MOS Inverters and MOS Combinational Circuits.

CO3: Summarize the power Dissipation and voltage scaling techniques in digital circuits.

CO4: Analyze the system level and circuit level approaches for low power VLSI.

CO5: Describe the approaches to minimize the leakage power for VLSI system.

CO6: Explain the software tools for low power VLSI circuit design.

PATTERN RECOGNITION					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A04H02	**3:0:0**	**4**	**CIE:30** **SEE:70**	**3 Hours**	**HONOR**

Course Objectives:

This course covers the techniques and gain proficiency of pattern recognition that are fundamental to a wide variety of application areas such as medical research Applications, biometrics Applications and computer vision Applications

Syllabus	**Total Hours: 48**
Unit –I	**10 Hrs**

Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Unit –II	**10 Hrs**

Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case. Maximum Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

Unit –III	**10 Hrs**

Dimensionality reduction: Principal component analysis - it relationship to Eigen analysis. Fisher discriminant analysis - Generalized Eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorization - a dictionary learning method

Unit –IV	**9 Hrs**

Linear discriminate functions: Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

Artificial neural networks: Multilayer perceptron – feed forward neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

Unit –V	**9 Hrs**

Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART). (3)

Application(s): Face recognition - preprocessing, face detection algorithms, selection of representative patterns, classification algorithms, results and discussion.

Text Books:

1. O.Duda, P.E.Hart and D.G.Stork, *Pattern Classification*, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, *Pattern Recognition*, 4th Ed., Academic Press, 2009

References:

1. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2. P.A Devijver and J. Kittler, Pattern Recognition: A Statistical Approach, Prentice-Hall International, Englewood Cliffs, NJ, 1980.
3. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Ed. Academic Press, New York, 1990.

Course Outcomes:

After the completion of the course students will able to:

CO1: A good knowledge of Bayesian decision theory and Bayesian learning.

CO2: Fundamental understanding of classifiers such as linear discriminate function, quadratic discriminate function, nearest neighbor rule, neural network and SVM.

CO3: A good understanding of feature selection algorithms.

CO4: Ability to evaluate the performance of various classifiers on real-world datasets.

CO5: To design and develop machine learning systems.

CO6: Ability to evaluate the performance of various classifiers on real world data sets.

SOFTWARE DEFINED RADIO					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A04H03	**3:0:0**	**4**	**CIE:30** **SEE:70**	**3 Hours**	**HONOR**

Course Objectives:

- Learn the design of the wireless networks based on the cognitive radio
- Understand the concepts of wireless networks and next generation networks

Syllabus

Unit –I

Introduction to Software Defined Radio: Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

Unit –II

SDR Architecture: Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

Unit –III

Introduction to Cognitive Radios: Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

Unit –IV

Cognitive Radio Architecture: Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

Unit –V

Next Generation Wireless Networks: The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Text Books:

1. Joseph MitolaIII, Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering, John Wiley & Sons Ltd., 2000.
2. Thomas W. Rondeau, Charles W. Bostain, Artificial Intelligence in Wireless communication, ARTECH house, 2009.

References:

1. Bruce A. Fette, “Cognitive Radio Technology”, Elsevier, 2009.
2. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, “Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey” Elsevier Computer Networks, May 2006.
3. Hasari Celebi, Huseyin Arslan, Enabling Location and Environment Awareness in Cognitive Radios, Elsevier Computer Communications, Jan 2008.
4. Huseyin Arslan, Cognitive Radio, SDR and Adaptive System, Springer, 2009.

Course Outcomes:

After the completion of the course students will able to

- Describe basics of the software defined radios.
- Understand the architectures of SDR.
- Understand the concept of Cognitive Radio Architecture.
- Understand various functions, components and design rules regarding Cognitive Radio Architecture.
- Design the wireless networks based on the cognitive radios.
- Explain the concepts behind the wireless networks and next generation networks.

MICRO ELECTRO MECHANICAL SYSTEMS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A04H04	3:0:0	4	CIE:30 SEE:70	3 Hours	HONOR

Course Objectives:

- To impart knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To understand the fundamentals of Micro fabrication techniques.
- To learn various sensors and actuators and different materials used for MEMS
- To outline the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Syllabus	Total Hours: 48

Unit –I — **10 Hrs**

Introduction: Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit –II — **10 Hrs**

Sensors and Actuators-I: Electrostatic sensors Electrostatic sensors Electrostatic sensors – Parallel plate capacitors – Applications – Inter digitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation.

Unit –III — **10 Hrs**

Sensors and Actuators-II: Piezo resistive sensors – Piezo resistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Unit –IV — **9 Hrs**

Bulk Micromachining and Silicon Anisotropic Etching: Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit –V — **9 Hrs**

Polymer and Optical Mems: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Textbooks:

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

References:

1. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
2. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2002
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
4. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the operation of micro devices, micro systems and their applications

CO2: Understand the concept of Electrostatic sensors

CO3: Understand the operation of Piezo resistive sensors

CO4: Choose a micromachining technique, such as bulk micromachining and surface micromachining for a specific MEMS fabrication process

CO5: Simplify the design of micro devices, micro systems using the MEMS fabrication process.

CO6: Understand the concept of polymer and optical MEMS

WIRELESS COMMUNICATIONS					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A04H05	**3:0:0**	**4**	**CIE:30 SEE:70**	**3 Hours**	**HONOR**

Course Objectives:

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

Syllabus	**Total Hours: 48**
Unit –I (Wireless Channels)	**10 Hrs**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

Unit –II (Cellular Architecture)	**10 Hrs**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity trunking & grade of service – Coverage and capacity improvement.

Unit –III (Digital Signaling For Fading Channels)	**10 Hrs**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR..

Unit –IV (Multipath Mitigation Techniques)	**9 Hrs**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

Unit –V (Multiple Antenna Techniques)	**9 Hrs**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and Non-fading channels.

Text Books:

1. Rappaport,T.S., ―Wireless communications, Pearson Education, Second Edition, 2010. (UNIT I, II, IV)
2. Andreas.F. Molisch, ―Wireless Communications, John Wiley – India, 2006. (UNIT III,V)

References:

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and PramodViswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. UpenaDalal, ―Wireless Communication‖, Oxford University Press, 2009.

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the concepts of wireless communications and standards

CO2: Characterize a wireless channel and evolve the system design specifications.

CO3: Analyze working of wireless technologies

CO4: Design a cellular system based on resource availability and traffic demands

CO5: Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

CO6: Plan a wireless system for deployment

VLSI TESTING & TESTABILITY					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A04H06	**3:0:0**	**4**	**CIE:30 SEE:70**	**3 Hours**	**HONOR**

Course Objectives:

- To impart knowledge on the basic faults that occur in digital systems
- To describe fault detection techniques in combinational circuits.
- To outline procedures to generate test patterns for detecting single stuck faults in combinational and sequential circuits.
- To explain design for testability techniques with improved fault coverage.
- To introduce BIST concepts and specific architectures.
- To give exposure to approaches for introducing BIST into logic circuits, memories and embedded cores.

Syllabus	**Total Hours: 48**
Unit –I::Introduction to VLSI Testing & Testability	**10 Hrs**

Introduction to Test and Design for Testability (DFT) Fundamentals, Modelling: Modelling digital circuits at logic level, register level and structural models, Levels of modelling, Logic Simulation: Types of simulation, Delay models, Element evaluation, Hazard detection, Gate level event driven simulation.

Unit –II::Fault Modelling	**10 Hrs**

Fault Modelling – Logic fault models, Fault detection and redundancy, Fault equivalence and fault location. Single stuck and multiple stuck – Fault models. Fault simulation applications, General techniques for Combinational circuits.

Unit –III::Fault Simulation	**10 Hrs**

Testing for single stuck faults (SSF), Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits, Functional testing with specific fault models, Vector simulation – ATPG vectors, formats, Compaction and compression, Selecting ATPG Tool.

Unit –IV::Design for testability	**9 Hrs**

Design for testability – testability trade-offs, techniques. Scan architectures and testing – controllability and Observability, generic boundary scan, full integrated scan, storage cells for scan design. Board level and system level DFT approaches. Boundary scan standards, Compression techniques – different techniques, syndrome test and signature analysis.

Unit –V::Built-in self-test (BIST)	**9 Hrs**

Built-in self-test (BIST): BIST Concepts and test pattern generation. Specific BIST Architectures – CSBL, BEST, RTS, LOCST, STUMPS, CBIST, CEBS, RTD, SST, CATS, CSTP, BILBO. Brief ideas on some advanced BIST concepts and design for self-test at board level.

Memory BIST (MBIST): Memory test architectures and techniques – Introduction to memory test, Types of memories andintegration, Embedded memory testing model. Memory test requirements for MBIST. Brief ideas on embedded core testing.

Text Books:

1. Digital Systems Testing and Testable Design, MironAbramovici, Melvin A. Breur, Arthur D. Friedman, Jaico Publishing House, 2001.
2. Design for Test for Digital ICs & Embedded Core Systems, Alfred Crouch, Prentice Hall.

References:

1. Introduction to VLSI Testing, Robert J. Feugate, Jr., Steven M. Mentyn, Prentice Hall, Englehood Cliffs, 1998.
2. Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits, Bushnell, M., and Agrawal, Vishwani D, Kluwer Academic Publishers,2002

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the Need and Necessity of Testing & Testability of VLSI Circuits.

CO2: Model digital circuits at logic and RTL levels.

CO3: Simulate digital ICs in the presence of faults and evaluate the given test set for fault coverage.

CO4: Generate test patterns for detecting single stuck faults in combinational and sequential circuits.

CO5: Identify schemes for introducing testability into digital circuits with improved fault coverage.

CO6: Compare different approaches for introducing BIST into logic circuits, memories & embedded cores.

ARM BASED EMBEDDED SYSTEM DESIGN

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A040H07	3:0:0	4	CIE:30 SEE:70	3 Hours	HONOR

Course Objectives:

- To get knowledge in system design using Micro controllers.
- To Study the architectural features and programming aspects of ARM controllers/processors.
- To learn about memory management in the system design applications.
- To develop software and program for an embedded system.
- To analyze operating systems concepts, types and choosing RTOS.
- To Design, implement and test an embedded system.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**

ARM Embedded Systems: An Embedded System-Definition, Embedded System Design and Development, Life Cycle, Embedded system Architecture, Embedded Systems classification, The RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM processor Families, Core extensions, Architecture Revisions.

Unit –II	10 Hrs

ARM Programming Model-I Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

Unit –III	9 Hrs

ARM Programming Model-II Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions

Unit –IV	10 Hrs

ARM Programming: Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.

Unit –V	9 Hrs

Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Content Switch.

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guide-Designing & Optimizing System Software", 2008, Elsevier.
2. 2. Jonathan W. Valvano – Brookes / Cole, 1999, "Embedded Microcomputer Systems, Real Time Interfacing", Thomas Learning.

References:

1. Intel and ARM Data Books on Microcontrollers.
2. Embedded System Design-Frank Vahid/Tony Givargis, John Willey, 2005.
3. Microcontroller (Theory and Applications) Ajay V Deshmukh, Tata McGraw- Hill, 2005.
4. An Embedded Software Primer-David E.Simon, Pearson Education, 1999.

E-learning resources:

1. nptel.ac.in/courses/ARM embedded systems design
2. https:www.ARMembedded.com
3. An embedded software premier/http://books.google.co.in

Course Outcomes:

After the completion of the course students will able to:

CO1: Gets complete knowledge about the system design concepts using Micro controllers.

CO2: Understand thoroughly the architectural and programming concepts of ARM controllers.

CO3: Know about the memory management concepts in system design.

CO4: Identify the significance of Real Time Operating Systems.

CO5: Analyze the types of memory and interfacing to external hardware

CO6: Describe embedded firmware design approaches

SEMICONDUCTOR DEVICE MODELING					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A04H08	**3:0:0**	**4**	**CIE:30 SEE:70**	**3 Hours**	**HONOR**

Course Objectives:

- This course provides a solid foundation in the physics of semiconductors so that students will be able to not only understand current devices and exploit the novel applications.
- It also appreciates the workings of new semiconductor devices as they materialize and evolve in future years.

Syllabus	**Total Hours: 48**
Unit –I: Semiconductor Physics	**10 Hrs**
Metals, insulator, semiconductors, intrinsic and extrinsic semiconductors, direct and indirect band gap, free carrier densities, Fermi distribution, density of states, Boltzmann statistics, thermal equilibrium, current flow mechanisms, drift current, diffusion current, mobility, band gap narrowing, resistance, generation and recombination, lifetime, internal electro-static fields and potentials, Poisson's equation, continuity equations, drift-diffusion equations	
Unit –II: PN-Junction Diodes	**10 Hrs**
Thermal equilibrium physics, energy band diagrams, space charge layers, internal electro-static fields and potentials, reverse biased diode physics, junction capacitance, wide and narrow diodes, transient behavior, transition, diffusion capacitance, small signal model.	
Unit –III: Bipolar Transistors	**10 Hrs**
Basic theory and operation, heavy doping effects, double diffused transistors, Eber's-Moll model, low forward bias, junction and diffusion capacitance, transit times, parasitic, small-signal models, Early effect, saturation and inverse operation, breakdown mechanisms, punch-through.	
Unit –IV: MOS Transistors	**9 Hrs**
MOS capacitor, accumulation, depletion, strong inversion, threshold voltage, contact potential, oxide and interface charges, body effect, drain current, saturation voltage, gate work function, channel mobility, sub-threshold conduction, short channel effects, effective channel length, effects of channel length and width on threshold voltage, Compact models for MOSFET and their implementation in SPICE. Level 1, 2 and 3, MOS model parameters in SPICE.	
Unit –V: UDSM Transistor Design Issues	**9 Hrs**
Short channel and ultra short channel effects; Effect to$_X$, effect of high k and low k dielectrics on the gate leakage and Source –drain leakage; tunneling effects; different gate structures in UDSM-impact and reliability challenges in UDSM.	

Text Books:

1. Y.P. Triviids, The MOS Transistor, Mc Graw-Hill, international editioned, 1988.
2. Nandita Das Gupta, Amitava Das Gupta, Semi conductor Devices: Modeling and Technology, PHI
3. S. M. Sze, Semiconductor Devices Physics and Technology, John Wiley & Sons Inc, (2/e).

References:

1. Getreu, Modeling the bipolar transistor, New York, NY: Elsevier, 1978.
2. D. Roulston, Bipolar Semi conductor Devices, Mc GrawHill, 1990.
3. N.Arora, MOSFET Models for VLSI Circuit Simulation, Springer-Verlag, 1993.

Course Outcomes:

After the completion of the course students will able to:

CO1: Apply their knowledge in analyzing Semiconductor devices.

CO2: Understand fundamentals of energy band theory in semiconducting materials

CO3: Understand the characteristics of diodes and transistors

CO4: Classify and analyze the various circuit configurations of Bipolar and MOS Transistors

CO5: Demonstrate the knowledge of MOS Transistors and their characteristics.

CO6: Analyze the concepts of UDSM and observe its characteristics.