B.Tech (Electronics and Communication Engineering)
ProgrammeSyllabus

Regulations 2018

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To be a lead department imparting quality and value embedded higher education and research emphasizing freedom of learning and practice.

MISSION

- Transforming students into full-fledged professionals and to become leaders in dynamic global environment.
- Augmenting knowledge and technologies in rapidly advancing fields of Electronics and Communication Engineering**.**
- Promoting in depth research and create centre of excellence in thrust areas.

Program Educational Objectives (PEOs) of ECE:

The Educational Objectives of UG Program in Electronics and Communication Engineering are:

1. To produce competent graduates in core areas of Electronics and Communication Engineering with adequate analytical capabilities and practical knowledge to attend to the current challenging tasks and to absorb futuristic trends.

2. To provide strong foundation in basic sciences and communication skills.

3. To keep the students abreast with the latest hardware and software design techniques and cutting edge technologies

4. To enhance the knowledge and skills continually throughout their career and to make them capable to adapt in diverse environments.

5. To imbibe leadership qualities among the students to take up challenging roles in their career by ensuring professional ethics with high sense of social responsibility.

PROGRAM OUTCOMES of ECE:

The program outcomes are the skills and knowledge which the graduates have at the time of graduation:

A. An ability to apply knowledge of mathematics, science, and engineering to solve engineering problems.
B. Capability to design and conduct experiments, as well as to analyze and interpret data
C. Identify, formulate, and solve engineering problems
D. Solving different types of problems associated with multi-disciplinary areas
E. Apply ethical principles and professional ethics and norms of engineering practice
F. Equipped to design a engineering system, component, or process that meets the specific needs with proper eco system
G. Disseminating knowledge effectively with engineering community and in general society.
H. The broad knowledge provided to understand the impact of engineering solutions in a global, economic, environmental, and societal context
I. A recognition of the need for, and an ability to engage in life-long learning
J. A knowledge of contemporary issues
K. An ability to select and use the appropriate advanced techniques, skills, and modern engineering tools necessary for engineering practice, with an understanding of limitations.
L. Will be in a position to participate and become successful in competitive examinations like GATE, IES,GRE,CAT,Civil services etc.

Program Educational Objectives	**Program Outcomes**											
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
1		**X**	**X**	**X**		**X**					**X**	**X**

2	**X**		**X**	**X**		**X**	**X**				**X**	**X**
3		**X**		**X**		**X**		**X**		**X**	**X**	
4	**X**			**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**
5			**X**		**X**		**X**	**X**	**X**	**X**		**X**

Abstract about B.Tech syllabus in ECE

Department of Electronics and Communication Engineering is offering a B.Tech program with an intake of 66(Plus 10% in the Second year through EECET). The syllabus revision was carried out in 2018 and 2020 as per the AICTE model curriculum and APCHE. A standard academic format common for all UG programs describing numbers of credits, weightage for lectures, laboratory work, and projects has been fixed considering the scope of the study. Mandatory Induction program for students to be offered right at the start of the first year with a duration of One weeks which cover Physical activity like Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas Familiarization to Dept./Branch & Innovations. Mandatory courses that are introduced are Constitution of India/Essence of Indian Traditional Knowledge. These courses will help students to deal with the outside world. Students are encouraged to enroll in open electives through MOOCs. The MOOCs can be done through Nptel, Coursera, Udemy, Skillshare, EdX, Udacity, Pluralsight, etc., The weightage is up to 40% of the total credits offered to the Program.-.The project work is initiated in the VII semester as Project Stage-I and Project Stage-II in the VIII semester. The internship is made mandatory which will make them get exposed to industrial needs. New courses are added to the curriculum whenever it is needed. This ensures they are on par with others.

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering, Effective from 2018-19

FIRST SEMESTER

Course Code	Course Title	Instruction hr / week			Credits
		L	T	P/D	
MABST 101	**Mathematics–I**	3	1	0	4
PYBST 102	**Modern Physics**	3	1	0	4
CSEST 103	**Programming for Problem Solving**	2	1	0	3
ECEST 104	**Electronic Devices**	3	1	0	4
MEESP 105	**Workshop/ManufacturingPractices**	0	0	3	1.5
CSESP 106	**Programming for Problem Solving Lab**	0	0	3	1.5
CEACT 107	**EnvironmentalScience**	4	-	-	-
	TOTAL	**15**	**04**	**06**	**18**

L – Lecturer hours; T – Tutorials; P/D – Practical or Drawing

SECOND SEMESTER

Course Code	Course Title	Instruction hr / week			Credits
		L	T	P/D	
MABST 201	**Mathematics–II**	3	1	0	4
CYBST 202	**Engineering Chemistry**	3	1	0	4
HSENT 203	**English**	2	0	0	2
EEEST 204	**Basic Electrical Engineering**	3	1	0	4
MEEST 205	**Engineering Graphics & Design**	2	0	3	3.5
HSENP 206	**English Communications Lab**	0	0	3	1.5
	Total	**13**	**03**	**06**	**19**

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THIRD SEMESTER

Course Code	Course Title	Instruction hr / week			Credits
		L	T	P/D	
MABST301	**Mathematics-III**	3	1	0	**4**
EEPCT302	**Network Theory**	3	0	0	**3**
ECPCT303	**Electromagnetic Waves**	3	0	0	**3**
ECPCT304	**Digital System Design**	3	0	0	**3**
HSMCT305	**Economics**	2	0	0	**2**
HSMCT306	**Accountancy**	2	0	0	2
ECPCP307	**Electronic Devices Lab**	0	0	2	**1**
ECPCP308	**Digital System Design Lab**	0	0	2	**1**
EEESP 309	**Basic Electrical Engineering Lab**	0	0	2	**1**
HSACT310	**Constitution of India**	2	0	0	**0**
	TOTAL	**18**	**01**	**06**	**20**

FOURTH SEMESTER

Course Code	Course Title	Instruction hr / week			Credits
		L	T	P/D	
ECPCT401	Analog Circuits	3	0	0	3
ECPCT402	Signals and Systems	3	0	0	3
ECPCT403	Probability Theory and Stochastic Processes	3	0	0	3
ECPCT404	Analog and Digital Communication	3	0	0	3
CSPCT405	Computer Organization and Architecture	3	0	0	3
HSMCT406	Management Science	3	0	0	3
HSMCT407	Psychology	2	0	0	2
ECPCP408	Analog Circuits Lab	0	0	2	1
ECPCP409	Analog and Digital Communication Lab	0	0	2	1
	TOTAL	20	0	4	22

FIFTH SEMESTER

Course Code	Course Title	Instruction hr / week			Credits
		L	T	P/D	
EEPCT501	Linear Control Systems	3	0	0	3
ECPCT502	IC Applications	3	0	0	3

ECPCT503	**Microcontrollers**	3	0	0	3
ECPCT504	**Digital Signal Processing**	3	0	0	3
ECPET505	**Electronic Measurements**	3	0	0	3
ECOET506	**Open Elective - I**	3	0	0	3
ECOET507	**OpenElective-II (MOOCs)**	3	0	0	3
ECPCP508	**IC Applications Lab**	0	0	2	1
ECPCP509	**Microcontrollers Lab**	0	0	2	1
ECPCP510	**Digital Signal Processing Lab**	0	0	2	1
	TOTAL	**21**	**0**	**6**	**24**

SIXTH SEMESTER

Course Code	**Course Title**	**Instruction hr / week**			**Credits**
		L	**T**	**P/D**	
ECPCT601	**Computer Networks**	3	0	0	3
ECPET602	**Program Elective - I**	3	0	0	3
ECPET603	**Program Elective – II (MOOCs / e_Learning)**	3	0	0	3
ECOET604	**Open Elective-III**	3	0	0	3
ECOET605	**Open Elective-IV**	3	0	0	3
ECPCP606	**Computer Networks Lab**	0	0	4	2
ECPCP607	**Electromagnetic Waves and Microwaves Lab**	0	0	2	1
ECPCP608	**Electronic Measurements Lab**	0	0	2	1
ECPXP609	**Electronic Design Workshop / Mini Project**	0	0	4	2
	TOTAL	**15**	**0**	**12**	**21**

SEVENTH SEMESTER

Course Code	**Course Title**	**Instruction hr / week**	**Credits**

		L	T	P/D	
ECPET701	**Program Elective-III**	3	0	0	3
ECPET702	**Program Elective -IV**	3	0	0	3
ECPET703	**Program Elective - V**	3	0	0	3
HSMCT704	**Total Quality Management**	4	0	0	4
ECPCI705	**Summer Industry Internship / Mini Project**	4 to 6 weeks			3
ECPXP706	**Project - I**	0	0	10	5
	TOTAL	**13**	**0**	**16**	**21**

EIGTH SEMESTER

Course Code	**Course Title**	**Instruction hr / week**			**Credits**
		L	**T**	**P/D**	
ECPET801	**Program Elective - VI**	3	0	0	3
ECPET802	**Program Elective - VII**	3	0	0	3
ECPXP803	**Project – II**	0	0	18	9
	TOTAL	**06**	**0**	**18**	**15**

PROGRAM ELECTIVE COURSES(ECPET - - -)

Sl.No.	**Program Elective Courses**	Sl.No.	**Program Elective Courses**
1.	Pulse and Digital Circuits	2.	Antennas and Propagation
3.	Microwave Theory and Techniques	4.	CMOS Design
5.	Information Theory and Coding	6.	Embedded Systems
7.	Satellite Communication	8.	Wireless Sensor Networks
9.	Neural Networks and Fuzzy Logic	10.	Introduction to MEMS
11.	Fiber Optic Communication	12.	Digital Design through HDLs
13.	Error Correcting Codes	14.	Mobile Communication and Networks
15.	Nano Electronics	16.	Scientific Computing
17.	Digital Image & Video Processing	18.	Bio-Medical Electronics
19.	Adaptive Signal Processing	20.	Speech and Audio Processing

21.	Wavelet Theory and Applications	22.	Machine Learning
23.	Power Electronics	24.	Mixed Signal Design
25.	High Speed Electronics	26.	Internet of Things and Applications

MABST101 MATHEMATICS -I	
Instruction:Hours/Week : **3L:1T:0P**	**Credits: 4**
SessionalMarks:**40**	EndSemester ExaminationMarks:**60**

Course Objectives:

1. To analyze differential equations and solve them
2. To applydifferential equations to engineering problems.
3. To use shift theorems to compute the Laplace transform, inverse Laplace transform and the solutions of second order, linear equations with constant coefficients.
4. To solve an initial value problem for an n^{th} order ordinary differential equation using the Laplace transform.
5. To expand functions as power series using Maclaurin's and Talor's series
6. To draw an approximate shape by the study of some of its important characteristics such as symmetry, tangents, regions etc using curve tracingmethodto find length, area, volume.

UNITI

DifferentialEquations:Lineardifferentialequationsofsecondandhigherorderwithconstantcoefficients-particular integrals-homogeneous differential equations with variable coefficients-methodof parameters-simulation equations.

UNITII

LaplaceTransformsI:Laplacetransformsofstandardfunctions-inversetransforms-transformsofderivativesandintegrals-derivatives of transforms-integrals oftransforms.

UNITIII

Laplace Transforms II: Transforms of periodic functions-convolution theorem-applications to solutionof ordinary differentialequations.

UNITIV

Calculus: Roll's and Mean value theorems - Taylor's and Maclaurins's series-maxima and minima forfunctions of two variables - Infinite series - Convergence Tests series of positive terms - comparison,Ratiotests - Alternating series-Leibnitz'srule-Absoluteand conditionalconvergence.

UNITV

MultipleIntegrals:Curvetracing(bothCartesianandpolarcoordinate)-EvaluationsofdoubleandTriple integrals-changeoforderofintegrations-changeofvariablesofintegrations-simpleapplicationstoareasand volumes.

Text/ReferenceBooks

1. BSGrewal,Higher EngineeringMathematics,40thEdition,Khanna Publications,2007.
2. MKVenkataraman,EngineeringMathematics,NationalPublishingCompany,Chennai.
3. BVRamana,HigherEngineeringMathematics,6thReprint,Tata McGraw-Hill,2008.
4. BaliandIyengar,EngineeringMathematics,6thEdition,LaxmiPublications,2006.

CourseOutcomes:

Attheendof thecourse,studentswillbeableto

1. analyzedifferentialequations andsolvethem
2. applydifferentialequationstoengineeringproblems.
3. usetransformationtoconvertone type intoanothertypepresumablyeasiertosolve.
4. useshifttheoremstocomputetheLaplacetransform,inverseLaplacetransformandthesolutionsof secondorder, linearequationswith constantcoefficients.
5. solveaninitialvalueproblemforannthorderordinarydifferentialequationusingtheLaplacetransform.
6. expandfunctionsaspowerseriesusingMaclaurin'sandTalor'sseries
7. optimizetheproblemsrelatedtoOR,Computerscience,ProbabilityandStatistics

8. drawanapproximateshapebythestudyofsomeofitsimportantcharacteristicssuchassymmetry,tangents,regionsetcusingcurvetracingmethodtofindlength,area,volume.
9. usemultiple integralinevaluatingarea andvolumeofanyregionboundedbythe givencurves.

MAT01: Engineering Mathematics – I	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3		
CO2	3		3	2	1	1	2	2	2	3	3	3		
CO3	3		3	2	1	1	3	2	2	3	3	3		
CO4	3		3	3	1	1	3	2	2	3	3	3		
CO5	3		3	3	2	1	3	2	2	3	3	3		
CO6	3		3	2	1	1	2	2	2	3	3	3		
CO7	3		3	2	1	1	2	2	2	3	3	3		
CO8	3		3	2	1	1	2	2	2	3	3	3		
CO9	3		3	3	2	1	3	2	2	3	3	3		

PYBST102MODERN PHYSICS

Instruction:Hours/Week : **3L:1T:0P** **Credits: 4**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. To make students aware of basic crystallographic geometry, defect studies and estimation of crystal structure by diffraction techniques.
2. To provide students with sound knowledge of basic principles of quantum Mechanics and its applications in problem solving.
3. To understand the concept of electrical conductivity by classical and quantum free electron theories and distinguishing materials based on band theory of solids.
4. Basic principles of laser optics and applications and ultrasonics.
5. Quantum confinement and size dependent properties of nanomaterials, their synthesis and applications.

UNITI

Quantum Mechanics : Wave – Particle duality – de Broglie Concept of Matter Waves – Properties ofMatterWaves–DavisonandGermerExperiment–G.P.ThomsonExperiment–
Heisenberg'sUncertaintyPrinciple– Schrödinger's TimeIndependentand Time Dependent Wave equation–Significance of Wave Function – Electron in an Infinite Square Potential Well – Probability Densitiesand EnergyLevels.

UNITII

Band Theory of Solids : Classical Free Electron Theory of Metals – Success and Failures – QuantumFreeElectronTheory–FermiFactor–ElectroninPeriodicPotential–BlochTheorem–Kronig–
PenneyModel–Distinction betweenMetals , Insulatorsandsemiconductors-EnergyBandStructures.

UNITIII

Semiconductors – Introduction- Intrinsic and Extrinsic Semiconductors – Density of states – CarrierConcentrationsatEquilibrium-HallEffect.PNJunctionDiode–EnergyBandDiagram-
ForwardandReverse Bias- Current – Voltage characteristics – Applications : Zener Diode - Light Emitting Diode-Photodiode-SolarCell – SemiconductorLaser.

UNITIV

ElectromagnetismandmagneticpropertiesofMaterials:

Laws of Electrostatistics- Electric Current- Laws of Magnetism- Ampere`s, Faraday`s laws-MaxwellsEquations–Polarization-Permeabilityanddielectricconstant-Polarandnon-
polarDielectrics,Clausius-Mossottiequation, Applications of Dielectrics.
Magnetization-PermeabilityandSusceptibility-ClassificationofMagneticMaterials,Ferromagnetism-MagneticDomains andHesteresis, Applicationsof ferromagneticmaterials.

UNITV

NanoPhysics and Nanotechnology : Introduction to Nanomaterials –Properties: Optical Properties – Quantum Confinement – Electrical properties. Synthesis of Nanomaterials: Ball milling, Arc depositionmethod–ChemicalVapourDeposition-Pulsedlaserdeposition.CharacteristicsofC^{60}(Zero dimensional),CarbonNanotubes(OneDimensional)andGraphene(TwoDimensional).ApplicationsofNano materials.10 hrs.

TextBooks/Reference Books:

1. R.K.Gaur andS.L.Gupta "EngineeringPhysics"SultanandChandPub.,NewDelhi
2. S. P. Basava Raju " A Detailed Text Book of Engineering Physics" Sole Distributors, SubhashStoresBook Corner, Bangalore
3. Hitendra K.MalikandA.K.Singh"EngineeringPhysics"Tata MCGrawHillEducationPVt.Ltd.,New Delhi
4. M. N. Avadhanulu and P. G. Kshirsagar "A Text Book of Engineering Physics" S. Chand andCompanyPvt. Ltd., New Delhi
5. JohnAllison,"ElectronicEngineeringMaterialsandDevices"TataMcGrawHillPublications.
6. B.LTheraja,"Modern physics",S. Chand &Company.

7. V.Raghavan“MaterialScience”,Tata McGrawHillPublications.
8. M.S.RamachandraRaoandShubraSingh,"NanoscienceandNanotechnology"WileyIndiaPvt.Ltd, New Delhi

CourseOutcomes:

Attheendof thecourse, studentswillbeableto

1. develop appropriate competence and working knowledge of laws of modern Physics inunderstandingadvanced technicalengineeringcourses
2. understand the quantum mechanics and ultimately the quantum behavior of charged particleswhenthey arein motion.
3. identifyand apply appropriate analytical and mathematical toolsofPhysicsinsolvingEngineeringproblems
4. applyknowledgeofbandtheoryintheareaofelectronicsandunderstandingthebasicelectrontransportationphenomenon in micro devices.
5. understand the principles in electrostatics and electromagnetics and magnetic properties ofmaterials.
6. understandsizedependedpropertiesofnanodimensionalmaterialsandtheireffectiveutilization in making nano- and micro-devices for further microminiaturization of electronicdevices.
7. think and participate deeply, creatively, and analytically in emerging areas of engineeringtechnology.
8. learnthe basics of instrumentation, design of laboratory techniques, measurement, dataacquisition,interpretation, andanalysis.
9. providemultidisciplinaryexperiencesthroughoutthecurriculum.

PHT 01: Engineering Physics	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	1	1	1	2	2	1		
CO2	3	3				1	1			1		1		
CO3	3	3	3	3	2	1	1	1	1	1	2			
CO4	2	**1**	**1**	**1**								1		
CO5	3	**2**	**2**	**2**	1	1				2	1	1		
CO6	1	**2**	**1**	**1**		3		2	1	2	1	1		

CSEST103PROGRAMMINGFORPROBLEM SOLVING

Instruction:Hours/Week : **2L:1T:0P** **Credits: 3**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. This course starts from the basics of program development.
2. To understand the various steps in Program development
3. It covers various concepts of C and C++ programming languages
4. To learn how to write modular and readable C Programs
5. To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures.
6. To understand the notations used to analyze the Performance of algorithms.
7. It introduces searching and sorting algorithms
8. To understand and analyze various searching and sorting algorithms

UNIT-I

Introduction toProgramming -Introduction to components of a computer system (disks, memory,processor,whereaprogramis storedandexecuted, operatingsystem, compilersetc.)-IdeaofAlgorithm:stepstosolvelogicalandnumericalproblems.RepresentationofAlgorithm:Flowchart/ Pseudocode with examples -From algorithms to programs; source code, variables (with datatypes)variablesandmemorylocations,SyntaxandLogicalErrorsincompilation,objectandexecutablecode -Arithmeticexpressions and precedence**.**

UNIT-II

Conditional Branching and Loops - Writing and evaluation of conditionals and consequent branching - Iterationand loops-Arrays(1-D, 2-D), Character arraysand Strings.

UNIT-III

BasicAlgorithms-Searching,BasicSortingAlgorithms(Bubble,InsertionandSelection)-Findingrootsofequations,notionoforder ofcomplexitythroughexample programs(noformaldefinitionrequired).

UNIT-IV

Functions -Functions (including using built in libraries), Parameter passing in functions, call by value,Passingarraystofunctions:ideaofcallbyreference -Recursion,asadifferentwayofsolvingproblems.Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc - Quick sort orMergesort.

UNIT-V

Structure -Structures, Defining structures and Array of Structures- Idea of pointers, Defining pointers,Use of Pointersinself-referentialstructures, notionof linkedlist(no implementation) Filehandling.

TextBooks/ReferenceBooks:

1. ByronGottfried,Schaum'sOutlineofProgrammingwithC,McGraw-Hill
2. E.Balaguruswamy,ProgramminginANSIC,Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia

CSEST103PROGRAMMINGFOR PROBLEM SOLVING	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3		
CO2	3		3	2	1	1	2	2	2	3	3	3		
CO3	3		3	2	1	1	3	2	2	3	3	3		
CO4	3		3	3	1	1	3	2	2	3	3	3		
CO5	3		3	3	2	1	3	2	2	3	3	3		
CO6	3		3	2	1	1	2	2	2	3	3	3		
CO7	3		3	2	1	1	2	2	2	3	3	3		
CO8	3		3	2	1	1	2	2	2	3	3	3		
CO9	3		3	3	2	1	3	2	2	3	3	3		
CO10	3		3	2	1	1	2	2	2	3	3	3		
CO11	3		3	3	2	1	3	2	2	3	3	3		

ECEST104ELECTRONICDEVICES

Instruction:Hours/Week : **3L:1T:0P** **Credits: 4**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

COURSE Objectives:

1.To understand PN Junction diodes, Zener diode, Tunnel diode, UJT.

2. To know the principle of operation of Rectifiers, Bipolar Junction Transistors, Field Effect Transistors and

optoelectronic Devices

UNITI

Semiconductor Materials: Atomic structure, Electrons in periodic Lattices, Classifying Materials:Semiconductors, conductors and insulators, Semiconductor material groups, Covalent bonding, EnergyBandgaps,Energy bands in intrinsic and extrinsic silicon /Germanium, Density of Impurity States,Electrical Conductivity and Mobility, , Electronic Properties of N-type and P-type semiconductors,Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design ofresistors. Generation and recombination of carriers; Poisson and continuity equation, P-N junctioncharacteristics, I-V Characteristics, and small signal switching models, Diode resistances and diodecapacitances.

UNITII

Diode models, Avalanche breakdown, Zener diode, Schottky diode, Tunnel diode, Varactor diode andtheir applications, Testing adiode.

Rectifiers: Diodeequivalentcircuits,Analysisofdiodecircuits,CharacteristicsandcomparisonofHalf-wave, Full-wave and Bridge rectifiers, Analysis of filters (C, L, LC, and CLC) used with Full-waverectifiers,lineregulation and load regulation.

UNITIII

Bipolar Junction Transistors: Bipolar Junction Transistor action, PNP and NPN transistors, CB, CE,andCCconfigurationsandtheirI-Vcharacteristics,Analyticalexpressionsfortransistorcharacteristics,Typicaljunctionvoltagesandmaximumratings.Determinationofh-parametersfromBJTcharacteristics,Ebers-MollModel, MultiEmittertransistor.

UNITIV

BipolarJunctionTransistor Biasing: Operatingpoint,stabilization,thermalrunaway.

Field Effect Transistors: Characteristics and parameters of JFET, Pinch off and saturation regions,MOS capacitor, Depletion and Enhancement type of MOSFET, I-V characteristics, and small signalmodels of MOS transistor, UJTand its I-V characteristics,Metal Semiconductor FET, FET biasingschemes.

UNITV

OptoelectronicDevices: PrincipleofoperationandcharacteristicsofLED.LCD,LDR,Photoconductor,Photod

iode, Phototransistor, Solar cell, PIN photodiode, Charge-Coupled Devices, APD (avalanchephotodiode) and theirapplications.

PowerSemiconductorDevices: Devicestructure,equivalentcircuitandcharacteristicsofPNPNDiode, SCR,DIACandTRIAC.

Text/ReferenceBooks:

1. BenG.SteetmanandSanjayKumarBanerjee,“SolidStateElectronicDevices,”7thedition,PearsonPublishers,2015.
2. JacobMillman,ChristosHalkias,ChetanDParikh,“**IntegratedElectronics**:AnalogandDigitalCircuitsandSystems”,2nd Edition, TataMcgrawHillEd.PrivateLimited,2011.
3. **AllenMottershead,“ElectronicDevicesandCircuits:**AnIntroduction”,PHILearning,2011.
4. D.Neamen,D.Biswas"Semiconductor PhysicsandDevices",McGraw-HillEducation.
5. S.M.SzeandK.N.Kwok,“PhysicsofSemiconductor Devices,”3rdedition,JohnWiley&Sons,2006.
6. C.T.Sah,“Fundamentalsofsolidstateelectronics,”WorldScientificPublishingCo.Inc,1991.
7. Y.TsividisandM.Colin,“OperationandModelingoftheMOSTransistor,”OxfordUniversityPress,2011.

Course outcomes:

Attheendof thiscourse,studentswillbeableto

1. understandthe principlesofsemiconductorphysicsoftheintrinsic,*p*and*n*typematerials.
2. understand the characteristics of the diode and some special function diodes and their application inelectroniccircuits.
3. usemathematicstoanalyze electronic devicestypicalofthoseinswitchingandrectifiercircuits.
4. understandandutilizethemathematicalmodelsofsemiconductorjunctionsandtransistorsforcircuitsand systems.
5. understand the characteristics of the Transistors and opto-electronic devices and their application inelectroniccircuits.
6. applythyristorsinpower switchingandcontrolcircuits.

ECT 02-Electronic devices	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	
CO4	3		3	3	2	1	3	2	2	3	3	3	3	

MEESP105WORKSHOP/MANUFACTURINGPRACTICE	
Instruction:Hours/Week : **0L:0T:3P**	**Credits: 1.5**
SessionalMarks:**40**	EndSemesterExaminationMarks:**60**

Course Objectives:

1. To impart training to the students in different crafts of workshop.
2. To make known about the importance of Carpentry, Welding in our daily life.
3. To identify what are runners, risers in a foundry shop, and welding equipment used in Gas welding and Arc welding.
4. To identify different smithy tools used in tin smithy.

WorkshopPractice:

1.Machineshop2. Fittingshop3.Carpentry4.Electricalwiring5.Weldingshop6.Casting7.Smithy
8.Plasticmoulding&GlassCutting
chooseanyoftheaboveFiveforpractice
Examinations could involve the actual fabrication of simple components, utilizing one orMoreofthetechniquescoveredabove.

Detailedcontents:

1. ManufacturingMethods-casting,forming,machining,joining,advancedmanufacturingmethods
2. CNCmachining,Additivemanufacturing
3. Fittingoperations&powertools
4. Electrical&Electronics
5. Carpentry
6. Plasticmoulding,glasscutting
7. Metalcasting
8. Welding(arcwelding&gaswelding),brazing

Theabovecoursecontentislearntbyonlinevideos/pptpresentations.

Text/ReferenceBooks:

1. HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"Elementsof WorkshopTechnology",Vol.I2008andVol.II2010,Mediapromotersandpublishersprivatelimited, Mumbai.
2. KalpakjianS.andStevenS.Schmid,"ManufacturingEngineeringandTechnology",4th edition, PearsonEducationIndia Edition,2002.
3. Gowri P.HariharanandA.SureshBabu,"ManufacturingTechnology–I"Pearson Education,2008.
4. RoyA.Lindberg,"ProcessesandMaterialsofManufacture",4 th edition,PrenticeHall India,1998.
5. RaoP.N.,"ManufacturingTechnology",Vol.IandVol. II,TataMcGrawHillHouse,2017

LaboratoryOutcomes

Uponcompletionofthislaboratorycourse,studentswillbeabletofabricatecomponentswiththeir own hands.

Theywillalsogetpracticalknowledgeofthedimensionalaccuraciesanddimensionaltolerancespossiblewith differentmanufacturing processes.

Byassemblingdifferentcomponents, they willbeabletoproducesmalldevicesoftheir interest.

Course Outcomes

Uponcompletionofthiscourse,thestudentswillgainknowledgeofthedifferentmanufacturing processeswhicharecommonlyemployedintheindustry tofabricatecomponentsusingdifferentmaterials.

MEP 01:Workshop Practice	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	**2**	**2**										
CO2														
CO3														
CO4														
CO5														

CSESP106PROGRAMMINGFORPROBLEMSOLVINGLAB

Instruction:Hours/Week : **0L:0T:3P** **Credits: 1.5**
SessionalMarks:**40** EndSemesterExaminationMarks:**60**

Course Objectives:

1. To work with the compound data types
2. To explore dynamic memory allocation concepts
3. Able to design the flowchart and algorithm for real world problems
4. Able to write C and C++ programs for real world problems using simple and compound data types
5. Employeegood programming style, standards and practices during program development

AssignmentsinC

Variable typesandtypeconversions:
SimplecomputationalproblemsusingarithmeticexpressionsBranching and logicalexpressions:
Problems involving if-then-else structuresLoops,whileand forloops:
Iterative problems e.g., sum of series1DArrays:searching,sorting:
1D Array manipulation2D arrays andStrings
Matrix problems, String operationsFunctions,callby value
Simplefunctions
Numerical methods (Root finding, numerical differentiation, numerical integration):Programmingforsolving Numericalmethods problems
Recursion,structureofrecursivecallsRe cursivefunctions
Pointers, structures and dynamic memory allocationPointersand structures

AssignmentsinCandJAVA
File handlingFileope rations

CourseOutcomes:

Attheendof thecourse,studentswillbe abletodevelopProgrammingconceptsto

1. formulatesimplealgorithmsforarithmeticandlogicalproblems.
2. translate thealgorithmstoprograms(inClanguage).
3. testandexecutetheprogramsand correctsyntaxandlogicalerrors.
4. implementconditionalbranching,iterationandrecursion.
5. decomposeaproblemintofunctionsandsynthesize acompleteprogramusingdivideandconquerapproach.
6. use arrays,pointersand structurestoformulatealgorithmsandprograms.
7. apply programming to solve matrix addition and multiplication problems andsearchingand sorting problems.

and

toapplyprogrammingtosolvesimplenumericalmethodproblems,namelyrotfindingoffunction, differentiationoffunctionandsimpleintegration

CSESP106PROGRAMMINGFORPROBLEMSOLVINGLAB	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	
CO4	3		3	3	2	1	3	2	2	3	3	3	3	
CO5	3		3	2	1	1	2	2	2	3	3	3	3	
CO6	3		3	3	2	1	3	2	2	3	3	3	3	
CO7	3		3	2	1	1	2	2	2	3	3	3	3	
CO8	3		3	3	2	1	3	2	2	3	3	3	3	
CO9	3		3	2	1	1	2	2	2	3	3	3	3	
CO10	3		3	3	2	1	3	2	2	3	3	3	3	
CO11	3		3	2	1	1	2	2	2	3	3	3	3	

CEMCT107ENVIRONMENTALSCIENCE

Instruction:Hours/Week:4**L:0T:0P** **Credits: 0**
SessionalMarks:**100**

Course Educational Objective (CEOs):

1. To Impart basic knowledge about the environment and its allied problems
2. To apply knowledge in Economic development without destroying the environment
3. To have knowledge on renewable energy and non renewable energy sources
4. To know about the bio diversity and its concepts

UNITI

EnvironmentalStudiesandNaturalResources

Definition,ScopeandimportanceofEnvironment,Environmentalstudies,Needforpublic awareness

ComponentsofEnvironment-Atmosphere,Hydrosphere,Lithosphere.

Renewable and**NonRenewableResourcesandassociatedproblems**

Waterresources:Useandoverutilizationofsurfaceandgroundwater,floods,drought,conflictsoverwater,dams benefits and problems.

Forestresources:Useandoverexploitation,deforestation,casestudies.Timberextraction,mining,damsandtheir effects on forests and tribalpeople.

Landresources:Landasaresource,landdegradation,Maninducedlandslides,soilerosionanddesertification.

Mineralresources:Useandoverexploitation,Environmentaleffectsofextractingandusingmineralresources, case studies.

Foodresources:Worldfoodproblems,changescausedagricultureandovergrazing,effectsofmodernagriculture, fertilizer– pesticideproblems, water logging,salinity,Casestudies.

Energyresources:Growingenergyneeds,renewableandnonrenewableenergysources,useofalternateenergyso urces. Casestudies.

Role of anindividualinconservationof naturalresources.

UNITII

Ecosystemand Biodiversity

Ecosystem - Conceptofanecosystem.Structure andfunctionsofanecosystem.

Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession.Foodchains, food websand ecologicalpyramids.

Introduction,types,characteristicfeatures,structureandfunctionofthefollowingecosystem.

(a)Forestecosystem. (b)Grasslandecosystem

(c)Desertecosystem.(d) Aquaticecosystem(ponds,streams, lakes,rivers,oceans,estuaries)

Biodiversityanditsconservation:

Definition, genetic species and ecosystem

diversity.Biogeographicallyclassificationof India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.Biodiversityatglobal, Nationalandlocallevels.

India as a mega-diversity

nation.Hot-spotsofbiodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts.Conservationof biodiversity:in-situandex-situconservationof biodiversity.

UNIT–III

EnvironmentalpollutionandGlobalEffects

Definition,Causes,Effects,andcontrolmeasuresof(a)Airpollution(b)Waterpollution(c)Soilpollution(d) Marinepollution(e) Noise pollution(f)Thermalpollution (g) Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.Roleof an individualinprevention of pollution. Pollutioncase studies. Disastermanagement:Floods,earthquakes,cyclone,landslides,Tsunami.Climatecha nge-Globalwarming, Acidrain,Ozonedepletion.

UNIT–IV

EnvironmentIssuesandManagement

- Environment and Human health – Epidemic diseases, HIV/AIDS, Aviation Flue, Water BorneDiseases.
- Environmental Impact Assessment, Sustainable Development, Clean Production and CleanDevelopmentMechanisms
- EnvironmentLegislation:EnvironmentalProtectionAct,WaterAct,AirAct,WildLifeProtection Act, Forest Conservation Act, Public Liability & Insurance Act, Issues involved inEnforcementofEnvironmentallegislation.

UNIT– V

SocialIssuesand the Environment

- Populationgrowth,PopulationExplosion,PopulationControl,WomenandChildwelfare.
- Urbanization,Industrialization,Developmentprojects,ResettlementandRehabilitationofpeople– Problems concerned, Casestudies.
- Consumerism and Waste Products Conservation, Public Awareness, Water Conservation, Rainwaterharvesting,watershedmanagement,Wastelandreclamation,HumanRights,Valueeducati on,Environmentalethics- Issues and possiblesolution.

Role of informationTechnologyinEnvironmentandHumanHealth.

TextBooks/ReferenceBooks:

1. AnubhaKaushik &CPKaushik,Environmentalstudies,NewageInternationalPublishers,2008
2. BennyJoseph,Environmentalstudies,Tata McGraw-HillPublishers,2005
3. MChandraSekhar, EnvironmentalScience,Hi-Tech Publishers, 2004
4. KeerthinarayanaandDanielYesudian,PrinciplesofEnvironmentalSciencesandEngineering,Hi-Tech Publishers,2005
5. AmalK.Datta,IntroductiontoEnvironmentalScienceandEngineering,Oxford&IBHPublishingCo.Pvt. Ltd,2000
6. SanthoshkumarGarg,RajeshawriGargandRajniGarg,EcologicalandEnvironmentalstudies,Khannapu blishers, 2006
7. GilbertM,IntroductiontoEnvironmentalEngineeringandScience,MastersPublicationbyPrentice –HallofIndiaPrivate Ltd.,1991
   WilliamPCunninghamandMaryAnnCunningham,PrinciplesofEnvironmentalScience,Tata McGrawHillPublishingCo. Ltd,2002

CourseOutcomes:

Attheendof thecourse,studentswillbeableto

1. acquire knowledgein
   - diversecomponents ofenvironmentandnaturalresources
   - ecosystemandbiodiversity&itsconservationmethods
   - populationgrowthandhumanhealth
   - green technology
2. identifyandresolvethe issuesrelatedtosourcesofdifferenttypesofpollutions

3.providesolutionstoindividuals,industriesandgovernmentforsustainabledevelopmentofnaturalresources applyenvironmentalethicsinprotectionof diversifiedecosystems.

CET01 Environmental Studies	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	

MABST201 MATHEMATICSII

Instruction:Hours/Week : **3L:1T:0P** **Credits: 4**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. Rank of a matrix, Eigen values, Eigen vectors- Cayley Hamilton theorem- Quadratic forms- diagonalization
2. Gradient of a scalar, Divergence, Curl of a vector and related properties- line, surface, volume integrals Green's, Stokes' and Gauss divergence theorems and its applications.
3. Fourier Series- Harmonic analysis
4. Gamma and Beta Functions
5. Bessel function and Legender Polynomials

Unit I
Matrices: rankof amatrix-solutionofsystem oflinearequations-Eigenvalues,vectors–Canley-Hamiltontheorem-quadraticforms-diagonalization.

Unit II
Vector Calculus: Gradient, Divergence, Curl of a vector and related properties-line, surface, volumeintegrals- Green's,Stokes'sand GaussDivergencetheoremsanditsapplications.

Unit III
Fourier Series: Fourier series-even and odd functions, periodic functions-half range sine and cosineseries-harmonicanalysis.

Unit IV
SpecialFunctionsI:GammaandBetafunctions-seriessolutionsofdifferentialequations-ordinarypoints.

Unit V

Special Functions II: Bessel function-recurrence formulae-generating function for $J_n(X)$ - Lengenderpolynomials-recurrenceformulae-generatingfunctionfor$P_n(X)$-Rodriguez'sformula-orthogonalityofLengender polynomials.

Text/ReferenceBooks

1. BSGrewal,HigherEngineeringMathematics,40th Edition,KhannaPublications,2007.
2. MKVenkataraman,EngineeringMathematics,NationalPublishingCompany,Chennai.
3. BVRamana,HigherEngineeringMathematics,6th Reprint,Tata McGraw-Hill,2008.
4. BaliandIyengar,EngineeringMathematics,6th Edition,LaxmiPublications,2006.

CourseOutcomes:

Attheendof thecourse,studentswillbeableto

1. useranksofmatricestodecidewhetherthesystemoflinearequationsisconsistentor not
2. useCayley- Hamiltontheoremtofindinversesorpowersof matrices.
3. useEigenvaluesandvectorstoreduce Quadraticformstonormalform.
4. to analyze motion problems from real lines to curves and surfaces in 3-D and use tools such asdivergence and curl of vector and gradient, directional derivatives that play significant roles inmanyapplications.
5. useGreen'stheoremtoevaluateline integralsalongsimpleclosedcontoursontheplane
6. useStokes'theoremtogivea physicalinterpretationofthecurlofavectorfield
7. usethe divergence theoremtogivea physicalinterpretationofthe divergenceofavectorfield.

MAT 02: Engineering Mathematics –II	PO1	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2		2	2	2	1	1	1	1		
C02	3		3	2		2	2	2	1	1	1	1		
CO3	3		3	2		2	2	2	1	1	3	3		
CO4	3		3	2		2	2	2	1	1	2	2		

CO5	3		3	2		2	2	2	1	1	1	1		
CO6	3		3	2		2	2	2	1	1	1	1		
CO7	3		3	2		2	2	2	1	2	1	1		
CO8	3		3	2		2	2	2	1	2	1	1		
CO9	3		2	1		1	1	1	1	1	1	1		
CO10	3		2	1		1	1	1	1	1	1	1		

8. findtheFourierSeriestorepresentafunctionasaseriesofconstantstimessineandcosinefunctionsofdifferentfrequenciesin order toobserveperiodicphenomenon.
9. EvaluatecertainimproperintegralstomakethemsimplewithintroductionofGammaandBetafunctions.
10. studycertainspecialfunctionsthatariseinsolvingcertainordinarydifferentialequationstomodel many physicalphenomena.

CYBST202ENGINEERINGCHEMISTRY

Instruction:Hours/Week : **3L:1T:0P** **Credits: 4**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. To provide the information regarding hardness of water, effects of hard water in boilers and treatment methods to avoid bad effect on human health. And also to check the parameters of various water samples by experimental techniques.

2. To make students familiar with importance of electrochemical processes in nature and industry, like the coating of objects with metals or metal oxides through electro deposition, also to provide the information about new technological solar batteries.

3. To provide knowledge on the fuel properties to help in selecting good fuel for reducing the pollution based on its efficiency without much smoke and also to make aware of synthetic fuels.

4. To make aware of the design synthesis and analysis of polymers and their multi-faceted applications in Engineering, Airplane engineering and bio-medical engineering.

5. To make aware of compounding and processing of polymers and description of major polymers, structure property relations and application and to provide their relevance in the electric and electronic fields.

6. To provide the knowledge of manufacturing of cement and analysis of cement and also the classification and properties of refractories and ceramics.

UNITI

Atomicandmolecularstructure(12lectures)

Postulatesofquantumchemistry.Schrodingerequation.ParticleinaboxsolutionsMolecularorbitalsofdiatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals.Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene. Band structure ofsolidsand theroleofdoping on band structures

UNITII

Spectroscopictechniquesandapplications

Principlesofspectroscopyandselectionrules.Electronicspectroscopy.Fluorescenceanditsapplicationsin medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclearmagneticresonanceandmagneticresonanceimaging,surfacecharacterizationtechniques.

UNITIII

Chemicalequilibria,Intermolecularforcesandpotentialenergysurfaces

UseoffreeenergyinThermodynamicfunctions:energy,entropyandfreeenergy.Estimationsofentropyandfreeenergies.Freeenergyandemf.Cellpotentials,theNernstequationandapplications.Useoffreeenergy considerations in metallurgy through Ellingham diagram. Equations of state of real gases andcriticalphenomena.

UNITIV

Periodicproperties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms intheperiodictable,electronicconfigurations,atomicandionicsizes,ionizationenergies,electronaffinityand electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard softacidsand bases, molecular
geometries,Born-Habercycle, Theuseof reduction potentials,Propertiesofionic and covalentcompounds.

UNITV

Stereochemistry,**Organic reactionsand synthesisofadrugmolecule**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations andsymmetryandchirality,enantiomers,diastereomers,opticalactivity,absoluteconfigurationsandconformationalanalysis.Introductiontoreactionsinvolvingsubstitution,addition,elimination,oxidation,reduction,cyclizationandringopenings.Synthesisofacommonlyuseddrugmolecule.

Reference/TextBooks

1. Universitychemistry, byB.H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane3.FundamentalsofMolecularSpectroscopy,byC. N.Banwell
4. EngineeringChemistry(NPTELWeb-book), byB.L.Tembe,Kamaluddinand M.S.Krishnan
5. PhysicalChemistry, byP.W.Atkins
6. OrganicChemistry:StructureandFunctionbyK.P.C.VolhardtandN.E.Schore,5thEdition.
7. Principlesofphysicalchemistry,Puri,SharmaandPattania

CourseOutcomes:

Attheendof thecourse,studentswillbeableto

1. analysemicroscopic chemistryintermsofatomicandmolecularorbitalsandintermolecularforces.
2. rationalisebulkpropertiesandprocessesusingthermodynamicconsiderations.
3. distinguish the ranges of the electromagnetic spectrum used for exciting differentmolecularenergy levelsin various spectroscopictechniques
4. rationaliseperiodicpropertiessuchasionizationpotential,electronegativity,oxidation statesand electronegativity.
5. listmajor chemicalreactionsthatareusedinthesynthesisofmolecules.

CYT 01:Engineering Chemistry	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	**1**	1						1					
CO2	**1**	1	**3**						1					
CO3	**1**	**2**	**2**	**2**				2	1					
CO4	**1**	**1**	**2**	**2**	2	2	3	2	1	**1**				
CO5		**2**			1		1	1		**1**				

ENHST203ENGLISH

Instruction:Hours/Week : **2L:0T:0P** **Credits: 2**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. To introduce students elements of grammar and composition of English language.
2. To familiarize students with literary texts such as short stories and prose passages.
3. To maintain linguistic competence through training in vocabulary, sentence structures and pronunciation.
4. To develop communication skills by cultivating the habit of reading comprehension passages.
5. To train the students to develop the language skills like listening, speaking, reading and writing.
6. To initiate them into use of self-instructed learner friendly modes of language learing through competence.

UNITI

VocabularyBuilding

The concept of Word Formation- Root words from foreign languages and their use in English-AcquaintancewithprefixesandsuffixesfromforeignlanguagesinEnglishformderivatives-Synonyms,antonyms,and standardabbreviations.

UNITII

BasicWritingSkills

Sentence Structures – Use of phrases and clauses in sentences –Importance of proper punctuation -Creating coherence – Organizing principles of paragraphs in documents -Techniques for writingprecisely

UNITIII

IdentifyingCommonErrorsinWriting

Subject-verb agreement -Noun-pronoun agreement -Misplaced modifiers -Article -Prepositions -Redundancies-Clichés

UNITIV

Natureand Styleofsensible Writing

Describing - Defining - Classifying –Providing examples or evidence –Writing introduction andconclusion

UNITV

WritingPractices

Comprehension- PrécisWriting–EssayWriting

Reference/TextBooks:

1. PracticalEnglish Usage.MichaelSwan.OUP. 1995.
2. RemedialEnglishGrammar.F.T.Wood.Macmillan.2007
3. OnWritingWell.WilliamZinsser.HarperResourceBook.2001
4. StudyWriting.LizHamp-LyonsandBenHeasly.Cambridge UniversityPress.2006.
5. CommunicationSkills. SanjayKumarand Pushplata.Oxford UniversityPress. 2011.
6. ExercisesinSpokenEnglish.Parts.I-III.CIEFL,Hyderabad.OxfordUniversityPress

CourseOutcomes:

Attheendof thecourse,studentswillbeableto

1. learntheelementsofgrammarandcompositionof EnglishLanguage.
2. LearnliterarytextssuchasShortstoriesandprosepassages.

ENT01 English	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	-	-	1	3	3	3	-	3	-	-
CO2	-	-	-	-	-	-	2	2	3	2	1	3	-	-
CO3	-	-	-	-	-	-	-		2	2	2	3	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	-	2	-	3	-	-

CO6	-	-	-	-	-	-	-	-	-	2	-	3	-	-

3. maintain linguistic competence through training in vocabulary, sentence structures andpronunciation.
4. developcommunicationskillsbycultivatingthe habitofreadingcomprehensionpassages.
5. developthe languageskillslike listening,speaking,readingandwriting.
6. makeuseofself-instructedlearnerfriendlymodesoflanguagelearningthroughcompetence.

EEEST204BASICELECTRICALENGINEERING

Instruction:Hours/Week : **3L:1T:0P** **Credits: 4**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

UNITI
DCCircuits
Electricalcircuitelements(R,LandC),voltageandcurrentsources,KirchhoffcurrentandVoltagelaws,analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domainanalysis of first-orderRL and RCcircuits.

UNITII
ACCircuits
Representationofsinusoidalwaveforms,peakandrmsvalues,phasorrepresentation,realpower,reactivepower, apparentpower,powerfactor.Analysisofsingle-phaseaccircuitsconsistingofR,L,C,RL,RC,RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and currentrelationsin starand deltaconnections.

UNITIII
Transformers
Magneticmaterials,BHcharacteristics,idealandpracticaltransformer,equivalentcircuit,lossesintransformers, regulationandefficiency. Auto-transformerandthree-phase Transformerconnections.

UNITIV
ElectricalMachines
Single-phaseinductionmotor.Construction,workingtorque-speedcharacteristic-Constructionandworking of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speedcontrolofinductionmotor-Construction,working,torque-speedcharacteristic-Constructionandworkingofsynchronousgenerators andspeedcontrolof separately exciteddcmotor.

UNITV
ElectricalInstallations
IntroductiontoConvertersandInverters- Singlephaseandthreephasevoltagesource Inverters-Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires andCables,Earthing.TypesofBatteries,ImportantCharacteristicsforBatteries.Elementarycalculationsfor energyconsumption,powerfactor improvementandbatteryBackup.

Text /ReferencesBooks:

1. D.P.KothariandI.J.Nagrath,"Basic ElectricalEngineering",TataMcGrawHill,2010.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009.
3. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
4. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010

5.V.D.Toro,“ElectricalEngineeringFundamentals”,Prentice HallIndia,1989.

CourseOutcomes:

Attheendof thiscourse,studentswillbeableto

1. understandandanalyze basicelectricandmagneticcircuits.
2. studytheworking principlesofelectricalmachines andpowerconverters.
3. introducethecomponentsoflow-voltageelectricalinstallations.

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

MEEST205ENGINEERINGGRAPHICSANDDESIGN

Instruction:Hours/Week : **2L:0T:0P** **Credits: 3.5**

SessionalMarks:**40** EndSemesterExaminationMarks:**60**

UnitI
IntroductiontoEngineeringDrawing
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering Consections including the Rectangular Hyperbola (General method only);Cycloid, Epi-cycloid, Hypo-cycloandInvolutes.

Unit
IIScales
Scales–constructionofPlain&Diagonal Scales.
Projectionsofpoints,lines
Projections ofPointsandlinesinclinedtobothplanes,includingtraces;

UnitIII
Projectionsofplanes
Projectionsofplanes(Regular surfacesonly)inclinedPlanes-AuxiliaryPlanes;
ProjectionsofRegularSolids(Simplesolids-cylinder,cone,prism&pyramid)thoseinclinedtobothePlanes-Auxiliary Views;

UnitIV
IsometricProjections&Orthographicprojections
PrinciplesofOrthographicProjections-ConventionsDrawsimpleobjects,dimensioningandscale.Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views oflines,Planes, Simpleand compoundSolids;Conversion ofIsometric
ViewstoOrthographicViewsandVice-versa,Conventions;

UnitV
IntroductiontoCAD
CAD workstation and peripherals, Demonstrating knowledge of the theory of CAD software [such as:The Menu System, Toolbars Standard, Object Properties, Draw, Modify and Dimension, Drawing Area(Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (ButtonBars),TheCommandLine(whereapplicable),TheStatusBar,Differentmethodsofzoomusedin CAD,Selectanderaseobjects.;

Text/ReferenceBooks:

1. BhattN.D., PanchalV.M. &InglеP.R.,(2014), Engineering Drawing, CharotarPubl.House
2. Shah,M.B.&RanaB.C.(2008),EngineeringDrawingandComputerGraphics,PearsonEducation
3. AgrawalB.&AgrawalC.M.(2012),EngineeringGraphics,TMHPublication

4. Narayana,K.L. &PKannaiah (2008),Textbook on Engineering Drawing, Scitech Publishers
5. CorrespondingsetofCAD Software TheoryandUserManuals

CourseOutcomes:

Attheendof thecourse,thestudentwillbeableto

1.make a distinctionbetweenfirstangle projectionandthirdangle projectionofdrawing.
2 drawhyperbola,parabola,InvolutesandCycloidalcurves.
3. drawsectionsofsolidsincludingcylinders,cones,prismsandpyramids.
4. drawprojectionsoflines,planes,solidsandsectionsofsolids.
5. draworthographicprojectionsoflines,planes,andsolids.

MET 01 Engineering Graphics	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	**2**	**3**			**3**							
CO2														
CO3														
CO4														
CO5														

ENHSP206ENGLISHCOMMUNICATIONLAB

Instruction:Hours/Week:**0L:0T:3P** **Credits: 3**
SessionalMarks:**40** EndSemester ExaminationMarks:**60**

Course Objectives:

1. To enable students to use language software.
2. To make them aware of western accents.

ListeningComprehension-Pronunciation,Intonation, Stress andRhythm - CommonEverydaySituations: Conversations and Dialogues- Communicationat Workplace- Interviews -FormalPresentations

Reference/TextBooks:

1. PracticalEnglishUsage.MichaelSwan.OUP.1995.
2. RemedialEnglishGrammar.F.T.Wood.Macmillan.2007
3. OnWritingWell.WilliamZinsser.HarperResource Book.2001
4. StudyWriting.LizHamp –LyonsandBenHeasly.CambridgeUniversitypress.2006.
5. CommunicationSkills.SanjayKumarandPushpalata.OxfordUniversityPress.2011.
6. ExercisesinSpokenEnglish.PartsI-III.CIEFL,Hyderabad.OxfordUniversityPress

CourseOutcomes:

Thestudentwillacquirebasicproficiencyin Englishincludingreadingandlisteningcomprehension,writing and speakingskills.

ENP 01:English Communication Lab	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	-	2	-	-	3	-	-
CO 2	-	-	-	-	-	-	-	-	-	-	-	2	-	-

MABST 301 Mathematics – III

(Vector Analysis, Numerical Methods, Probability & Statistics)
(Common to EEE, ECE and CSE)

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course Objectives:

1. To introduce the solutionin Vector Analysis and Numerical Methods.
2. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering.
3. To provide an overview of probability and statistics to engineers
4. To provide an overview of Test of significance

UNIT-I

Vector Analysis:

Vectors in plane and space, vector operations, linear dependence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems. (10 hours)

UNIT-II

Numerical Methods:

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae, Numerical Differentiation.

Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. (12 hours)

UNIT-III

Numerical Methods

Differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations, Milne's and Adam's predicator-corrector methods,Finite difference solution two dimensional Laplace equation and Poission equation. (10 hours)

UNIT-IV

Probability, Basic Statistics, Measures of Central tendency:

Spaces, conditional probability, independence; the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, Mean, median, mode and standard deviation, Moments, skewness and Kurtosis Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regressionanalysis – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. (12 hours)

UNIT-V

Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. (12 hours)

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

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

1. Solve field problems in Vector Analysis and Numerical Methods
2. Solve field problems in engineering involving PDEs.

3. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.
4. They can formulate and solve problems Test of significance.

MAT 03:Engineering Mathematics –III	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2		2	1	1	2	2	1	1		
CO2	3		3	2		2	1	1	2	1	1	1		
CO3	3		3	2		2	1	1	2	1	1	1		
CO4	3		3	2		2	1	1	2	1	1	1		

EEPCT302Network Theory

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Objectives:

1.To Understand basics electrical circuits with nodal and mesh analysis.
2. To Appreciate electrical network theorems.
3. To Apply Laplace Transform for steady state and transient analysis.
4. To Determine different network functions.
5. To Appreciate the frequency domain techniques

UNIT-1

Network Solution Methods: Graph, tree, Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactance's, source transformation and dualityand dual circuits.

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

UNIT-2

Trigonometric and Exponential Fourier Series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation, Wye-Delta transformation, Steady state sinusoidal analysis using phasors, Time domain analysis of simple linear circuits.

UNIT-3

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions. Transient behavior, concept of complex frequency.

UNIT-4

Network Functions: One-port and Two-port networks, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem. Concept of complex frequency, poles and zeros, Time domain response from pole-zero diagram, Restrictions on pole-zero locations.

UNIT-5

Two-port Network Parameters : Open circuit impedance and short circuit admittance parameters – Hybrid and inverse-hybrid parameters – Transmission and inverse transmission parameters – Inter relationships between parameter sets – Series, Parallel, and Cascade connection of two-ports – Conditions for reciprocity and symmetry of two-port networks. Terminated two-port networks – Image parameters. Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text/Reference Books

1. Jack E. Kemmerly, William H. Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education, 2013.
2. Van, Valkenburg.; "Network analysis"; Prentice Hall of India, 2000.
3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

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

ECPCT303Electromagnetic Waves

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. To study the fundamental concepts of transmission lines at higher frequencies
2. Understand and analyze power flow in transmission line
3. Ability to analyze and design impedance matching methods
4. Ability to Understand Wave Propagation between parallel planes
5. Exposé the learner to waveguides their types and modes of transmissions

UNIT-1

Transmission Lines: Equations of Voltage and Current on Transmission line, Propagationconstant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on Transmission line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

UNIT-2

Time-Varying Fields andMaxwell's Equations- Basics of Vectors, Vector calculus, Basic laws ofElectromagnetics:Biot-Savart Law,Ampe're's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Faraday's Law, Displacement Current, Maxwell's Equations in Point Form and in Integral Form, Boundary conditions at Media Interface.

UNIT-3

Uniform Plane Wave: Uniform plane wave, Propagation of wave, Wavepolarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

Plane Waves at a Media Interface: Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

UNIT-4

Waveguides: Wave propagation in parallel planewaveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

UNIT-5

Radiation: Solution for potential function, Radiation from the Hertzian dipole, Powerradiated by Hertzian dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005.
2. William H. Hayt, Jr., John A. Buck, "Engineering Electromagnetics", 8th Edition, McGraw-Hill, 2010.
3. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines.
2. Carryout impedance transformation on transmission lines.
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave.
5. Calculate reflection and transmission of waves at media interface.
6. Analyze wave propagation on metallic waveguides in modal form.
7. Understand principle of radiation and radiation characteristics of an antenna.

ECPCT303Electromagnetic Waves	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	1	-	2	-	-	2	-	-	-	-	-	-	-	-
CO2	-	2	-	1	-	2	-	-	-	-	-	-	-	-
CO3	-	2	2	1	-	2	-	-	-	-	-	-	-	-
CO4	-	2	2	1	-	2	-	-	-	-	-	-	-	-

ECPCP304 Electronic Devices Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT 104.

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

ECPCT305Digital System Design

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. Provides introduction to logic designs and the basic building blocks used in digital systems.

2. To understand the number systems and codes, Boolean algebra, and logic gates.
3. To minimize the logical functions using Boolean algebra, K-maps, tabular method, and also to understand combinational circuits.
4. To understand different sequential circuits.
5. To understand different Arithmetic circuits.
6. To understand different programmable circuits

UNIT-1

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT-2

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

UNIT-3

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudorandom Binary Sequence generator.

UNIT-4

Clock generation Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

UNIT-5

VLSI Design flow: Design entry, Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd Edition, 2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

Course outcomes: At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits.
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder.

3. Design & analyze synchronous sequential logic circuits. 4. Use HDL & appropriate EDA tools for digital logic design and simulation.

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

ECPCP306Digital System Design Laboratory
Instruction : Hours/Week : **0L:0T:2P** **Credits: 1** Sessional Marks : **40** End Semester Examination Marks: **60**
Hands-on experiments related to the course contents ECPCT305.

EEESP307Basic Electrical Engineering Laboratory	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**	

List of experiments/demonstrations:

1. Basic safety precautions, Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
7. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (fieldwinging - slip ring arrangement) and single-phase induction machine.
8. Torque Speed Characteristic of separately excited dc motor.
9. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at supersynchronous speed.
10. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
11. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of power electronic converters.

Mappingofcourse outcomeswithprogramoutcomes:

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

MCHST308 Economics

Instruction : Hours/Week : **2L:0T:0P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Objectives:

1. To introduce to managerial Economics, Cost Analysis Production and Supply Analysis
2. To gain Knowledge in Price and Output Decisions Under Different Market Structures And Profit Management

UNIT – I

Introduction - Nature and Scope of Managerial Economics, Economic Theory and Managerial Economics, Managerial **Economist:** Role and Responsibilities. Demand Analysis and Forecasting – Demand Determinants, Demand Distinctions, Demand Forecasting: General Considerations, Methods of Demand Forecasting.

UNIT – II

Cost Analysis – Cost Concepts, Classifications and Determinants; Cost-Output Relationship, Economies and Diseconomies of Scale, Cost Control and Cost Reduction.

Production and Supply Analysis – Production Functions, Supply Analysis.

UNIT – III

Price and Output Decisions Under Different Market Structures – Perfect competition, Monopoly and Monopsony; Price Discrimination, Monopolistic Competition, Oligopoly and Oligopsony.

UNIT – IV

Pricing Policies and Practices – Pricing Policies, Pricing Methods, Specific Pricing Policies, Price Discounts and Differentials; Product-line Coverage and Pricing; Price Forecasting.

UNIT – V

Profit Management – Nature of Profit, Measuring Accounting Profit, Profit Policies, Profit Planning and Forecasting. Capital Management - Capital Budgeting, Cost of Capital, Appraising Project Profitability, Risk, Probability and Investment Decisions.

Text/Reference Books:

1. Varshney R L and Maheshwari K L, Managerial Economics, 19th Edition, Sultan Chand and Sons, 2009.
2. Froeb L M, and McCann B T, Managerial Economics*:* A Problem Solving Approach, Cengage Learning, 2008.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. To gain introduction to managerial economics and demand analysis
2. To estimate Cost Analysis Production and Supply Analysis
3. To understand Price and Output Decisions Under Different Market Structures
4. To be able to analyze Profit Management

MCHST308 Economics	PO1	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	
CO4	3		3	3	2	1	3	2	2	3	3	3	3	

MCHST309Accountancy

Instruction : Hours/Week : **2L:0T:0P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Objectives:

To introduce to managerial Accounting, Financial Statement Analyses and Methods of Depreciation
To gain Knowledge in Capital Budgeting and Marginal Costing

UNIT – I

Management Accounting: Definition, Objectives, Scope and Functions. Financial Accounting – Introduction, Process,
Principles and Concepts. Financial Statements – Trading Account, Balancing Process, Profit & Loss Account and Balance Sheet

UNIT – II

Financial Statement Analyses – Trend Percentage Analysis, Ratio Analysis, Fund Flow Statement Analysis, Cash Flow Statement Analysis.

UNIT – III

Methods of Depreciation – Straight line, Depletion, Machine Hour Rate, Diminishing Balance, Sum of Digits, Sinking Fund
and Insurance Policy Methods. Inventory Valuation Methods – FIFO, LIFO, Average Weighted Average, Base Stock and HIFO Methods.

UNIT – IV

Capital Budgeting – Pay Back Period, ARR, NPV, PI and IRR Methods. Unit Costing – Introduction, Direct Cost Classification and Indirect Cost Classification. Introduction to Process Costing, Job Costing and Activity Based Costing

UNIT – V

Marginal Costing – Introduction, Definition, Meaning and BEP Analysis and BEP in units. Standard Costing – Introduction, Variance Analysis Material Cost Variance, Material Price Variance, Labor Variance, and Sales Variance. Budgetary Control – Introduction and Classification of Budgets, Production, Material / Purchase, Sales, Sales Overhead, Cash and Factory Overheads Flexible Budget, Budgets.

Text Books:

1. Pandikumar M P, Management Accounting*:* Theory and Practice, 1st Edition, Excel Books, 2007.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. To gain knowledge in to managerial Accounting, and Financial Statement Analyses
2. To be able to know the methods of Depreciation
3. To gain Knowledge in Capital Budgeting
4. To get expertise in Marginal Costing

MCHST309Accountancy	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	
CO4	3		3	3	2	1	3	2	2	3	3	3	3	

MCHST310Constitution of India

Instruction : Hours/Week : **2L:0T:0P** **Credits: 0**

Course Outcomes: Students will be able to

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit-I

History of Making of the Indian Constitution: History
Drafting Committee, (Composition & Working)

Unit-II

Philosophy of the Indian Constitution: Preamble
Salient Features

Unit-III

- **Contours of Constitutional Rights & Duties:**
- Fundamental Rights
- Right to Equality
- Right to Freedom

- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit-IV

- **Organs of Governance:**
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit-V

- **Local Administration:**
- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit-VI

- **Election Commission:**
- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

MCHST310Constitution of India	PO1	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	1	1	2	2	2	3	3	3	3	
CO2	3		3	3	2	1	3	2	2	3	3	3	3	
CO3	3		3	2	1	1	2	2	2	3	3	3	3	
CO4	3		3	3	2	1	3	2	2	3	3	3	3	

ECPCT401Analog Circuits	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

Course objectives:

1. This course focuses on the characteristics and applications of various analog integrated circuits using operational amplifiers
2. To learn basics of the design and analysis of selected analog circuits including some specialized linear integrated circuits.

UNIT-1

General Amplifiers: Concept of Amplifier, Voltage gain, Current gain, Power gain, Input and Output resistances, Conversion efficiency, Frequency response, Bandwidth, Distortion, CE, CB and CC amplifiers, Approximate model analysis, Effects of coupling and bypass capacitors on low frequency response, Hybrid-Π model at high frequencies.

FET Amplifiers: Small signal model, Analysis of CS, CD and CG amplifiers.

UNIT-2

Multistage Amplifiers: Types of coupling, Choice of amplifier configuration, overall voltage gain and Bandwidth of n-stage amplifier, Darlington and Bootstrap circuits.

Power Amplifiers: Class-A large signal amplifiers, Transformer coupled audio power amplifiers, Push-pull amplifiers, Class-B amplifiers, Class-AB operation.

UNIT-3

Feedback amplifiers: Feedback concept, Classification, Effects of negative feedback on gain, Stability, Noise, Distortion, Bandwidth.

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Current mirror: Basic topology and its variants, V-I characteristics, outputresistance and minimum sustainable voltage (V_{ON}), maximum usable load.

UNIT-4

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.

Operational Amplifier : Ideal op-amp characteristics, design of differential amplifier for a given specification, design of gain stages and output stages, compensation, examples of IC op-amps, DC and AC characteristics, Inverting and non-inverting modes of operation, voltage follower.

UNIT-5

Digital-to-analog converters (DAC): Weighted resistor/converter, R-2R Ladder D/Aconverter,specifications for D/A converters.

Analogto-digital converters (ADC): Sample and hold circuit,quantization and encoding, parallel comparator A/Dconverter, Successive approximation A/D converter, counting A/D converter, dual slope A/Dconverter,A/Dconverterusingvoltagetofrequencyandvoltagetotimeconversion,specificationsofA/Dconverters.

Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Saunder's College Publishing, IV Edition.
5. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors.
2. Design and analyze various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.
5. Design ADC and DAC

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

ECPCP402 Analog CircuitsLaboratory
Instruction : Hours/Week : **0L:0T:2P** **Credits: 1** Sessional Marks : **40** End Semester Examination Marks: **60**
Hands-on experiments related to the course contents ECPCT401.

ECPCP402 Analog CircuitsLaboratory	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3

ECPCT403Analog and Digital Communication	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

Course objectives:

1. Understand concept of modulation and design of major building blocks of communication system.
2. Modulation techniques will be analyzed both in time and frequency domains.
3. To understand the communication systems. Signal modulation techniques will be emphasized.
4. Able to understand Signal Modulation (amplitude, frequency, and phase) and transmission techniques (base band, band pass) will be emphasized.
5. To develop a clear insight into the relations between the input and output ac signals in various stages of a transmitter and a receiver of AM & FM systems.
6. To develop the theoretical aspects of DCS, is essential to understand today's multi disciplinary applications.
7. To present the essential digital communication concepts by understanding the elements of DCS, fundamental concepts of sampling theorem and coding.
8. To discuss the different types of digital pulse and band pass signaling techniques.
9. To emphasize the analysis of performance of DCS in the presence of noise, by calculating the probability of error for matched filter Rx and various digital modulation techniques.
10. To understand the inform capacity of a channel by studying the concept of inform theory.
11. To know the efficient representation sources, by providing source coding techniques.
12. To provide knowledge about error detection and correction, different types of channel coding techniques

such as linear block codes cyclic code, and convolution codes are to be discussed.

UNIT-1

Frequency domain representation of signals, Principles of AmplitudeModulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of Frequency modulation (FM) andPhase modulation (PM) signals, Spectral characteristics of angle modulated signals. Super heterodyne receivers, circuits for analog communications.

Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

UNIT-2

Pulse Modulation: Sampling process,Quantization& Coding, Quantization error, Pulse Amplitude and Pulse Code Modulation (PCM), Line codes, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation,Noise considerations in PCMsystems, Time Division multiplexing(TDM), Digital Multiplexers.

UNIT-3

Base-band Data Transmission: Elements of Detection Theory, Geometric representation of signals, Gram-Schmidt Orthogonalization Procedure, Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, Optimum detection of signals in noise,inter-symbol interference (ISI) and its mitigation, Timing and frequency synchronization, Nyquist criterion for distortion less baseband binary transmission, ideal Nyquist channel,Raised-Cosine pulse spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Baseband M-array PAM transmission, Coherent communication with waveforms, Probability of Error evaluations,Eye diagrams.

UNIT-4

Digital Modulation Schemes: Method of generation and detection of coherent & noncoherent binary Amplitude, and Frequency Shift Keying (ASK, FSK), Phase Shift Keying (PSK), differential phase shift keying(DPSK), DEPSK, QPSK, M-ary PSK, Quadrature Amplitude Modulation (QAM), Continuous Phase Modulation and Minimum Shift Keying (MSK). M-array quadrature amplitude modulation (M-array QAM).

UNIT-5

Digital Modulation tradeoffs, Optimum demodulation of digital signals over band-limited channels-Maximum a posteriori (MAP) detection, Maximum likelihood(ML)sequence detection (Viterbi receiver), Equalization Techniques, Synchronization and Carrier Recovery for Digital modulation. Calculation of bandwidth,Comparison of power bandwidth requirements Signal to Noise Ratio (SNR) and Bit Error Rate (BER) for all digital modulationschemes.Basics of TDMA, FDMA and CDMA.

Text/Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Michael Moher, Simon Haykin“An Introduction to Analog & Digital Communications, 2ed
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems”, Tata McGraw Hill, 2001.
5. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth

2. Analyze the behavior of a communication system in presence of noise. 3. Investigate pulsed modulation / band pass modulation system and analyze their system performance. 4. Analyze different digital modulation schemes and can compute the bit error performance.

ECPCT403Analog and Digital Communication	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO4	3	3	2	2	-	1	-	-	-	-	1	2	3	3

ECPCP404 Analog and Digital Communication Laboratory
Instruction : Hours/Week : **0L:0T:2P** **Credits: 1** Sessional Marks : **40** End Semester Examination Marks: **60**
Hands-on experiments related to the course contents ECPCT403.

ECPCP404 Analog and Digital Communication Laboratory	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO4	3	3	2	2	-	1	-	-	-	-	1	2	3	3

EC PCT405Signals and Systems

(Common to EEE, ECE and CSE)

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. To create a foundation in signals and systems which will facilitate better understanding of higher level subjects like signal processing, control systems, communication systems etc.
2. To intrude signals and their representation in various domain and understand classification of signals.
3. To understand the transmission of signals through linear time invariant (LTI) system and introduce the types of convolution filters and their responses.
4. To introduce the concept of correlation and their properties.
5. To discuss the importance and application of Laplace transform.

To discuss the significance of Z-transform and its properties

1.

UNIT I

Introduction to Signals and Systems:

Definition and classification of signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character, Elementary signals such as Impulse, step, ramp, sinusoidal and exponential signals, Operations on signals. Basic System Properties (Continuous-Time and Discrete-Time):

linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability, Examples, Causal LTI Systems Described by Differential and Difference Equations.

Signal Analysis:
Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions.

UNIT II
Fourier series and Fourier Transform:
The Response of LTI Systems to Complex Exponentials. Fourier series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier series, Properties of Continuous-Time Fourier Series. The Continuous-Time Fourier Transform – properties. Discrete-Time Fourier Transform – Properties, Basic Fourier Transform Pairs. Introduction to Hilbert Transform.

UNIT III
Convolution and Correlation of Signals:
Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT IV
Behaviour of continuous and discrete-time LTI systems:
The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Distortion less transmission through a system, signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time, State-space Representation of systems, State-Space Analysis, Multi-input, multi-output representation.

Sampling and Reconstruction:
The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects.Relation between continuous and discrete time systems, Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

UNIT V
Laplace and z -Transform:
The Laplace Transform -The Region of Convergence - Properties, The Inverse Laplace Transform, Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, Unilateral Laplace Transform. The Z-Transform -Region of Convergence - Properties, The Inverse z-Transform, Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, Unilateral z-Transform.

Text / Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky, & S. Hamid Nawab, "Signals and Systems," Pearson Higher Education, 2nd Ed., 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. Simon Haykin and B. Van Veen, "Signals & Systems," John Wiley and Sons, 2nd Edition, 2007.
4. B.P. Lathi, "Principles of LINEAR SYSTEMS and SIGNALS," Oxford Univ. Press, Second Edition, International version, 2009.
5. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
6. Luis F. Chaparro, "Signals and Systems using MATLAB," Academic Press, 2011.
7. C. L. Philips, J. M. Parr and Eve A. Riskin, "Signals, Systems and Transforms," Pearson Education, 4th Edition, 2008.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Analyze different types of signals
2. Understand the concepts of continuous time and discrete time systems.
3. Analyse systems in complex frequency domain.
4. Investigate whether the system is stable or not.
5. Understand sampling theorem and its implications.

Mappingofcourseoutcomeswithprogramoutcomes:

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

EC PCT 406Probability Theory and Stochastic Processes

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. To find Distribution function, Density function, Characteristic and moment generating functions for different Random variables.
2. To find Joint distribution / Density functions – Conditional density / Distribution functions on multiple Random variables
3. To study properties of Random Processes.
4. To study different Linear Systems with Random Inputs
5. To evaluate Optimum Linear Systems.

UNIT-1

Sets and set operations, Probability space, Conditional probability Total Probability, and Bayes theorem, Combinatorial probability and sampling models.

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions. Continuous random variables, probability density function, probability distribution function, example distributions.

UNIT-2

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments, Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.

UNIT-3

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, Central Limit Theorem, (Proof not expected), Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-4

Random Process: Classification of Processes, Stationary processes, Mean and covariance functions, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function & Its Properties, Cross-Correlation Function & its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Power spectral density, Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT-5

Transmission of random process through LTI 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, properties of white noise, Band pass, Band-Limited and Narrowband Processes, Properties.

Text / Reference Books:

1. H. Stark and J. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education.
2. Athanasios Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.
3. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", Tata McGraw Hill, 4th Edition, 2001.
4. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers.
6. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.
7. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand representation of random signals.
2. Investigate characteristics of random processes.
3. Make use of theorems related to random signals.
4. Able to Model of different Noise Sources.
5. To understand propagation of random signals in LTI systems.

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

CSPCT407Computer Organization and Architecture
(Common to ECE and CSE)

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Objectives of the course: To expose the students to the following:

1. How Computer Systems work & the basic principles.
2. Instruction Level Architecture and Instruction Execution.
3. The current state of art in memory system design.
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism.
6. To impart the knowledge on micro programming.
7. Concepts of advanced pipelining techniques.

Course Outcomes: At the end of this course, student will demonstrate the ability to

1. Learn how computers work.

2. Know basic principles of computer's working.
3. Analyze the performance of computers.
4. Know how computers are designed and built.
5. Understand issues affecting modern processors (caches, pipelines etc.).

Unit 1:

Introduction to Computer organization: Basic Structure of Computers, Functional units, software, software performance issues, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines,CISC Vs RISC, Data types. (8 hours)

Unit2:

Processor organization: Multiplication, division, ALU design, data-path and Control unit, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit, Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit, Information representation, Number formats: Floating Point arithmetic, IEEE 754 floating point formats. (8 hours)

Unit 3:

Memory organization: System memory, RAM, ROM, Memory interleaving, concept of hierarchical memory organization, Concept of Cache memory & associative memories, Virtual memory and its implementation, Memory management unit, Semiconductor main memory, Advanced DRM organization, Optical Disks. (8 hours)

Unit4:

Input – Output Organization: Accessing I/O devices, Standard I/O interfaces,Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, I/O device interfaces – Parallel and serial port, Features of PCI and PCI Express bus,SCII, USB.(8 hours)

Unit 5:

Concept of parallel processing:

Pipelining: Basic concepts of pipelining, throughput and speedup, Instruction level pipelining (ILP), Compiler techniques for ILP, pipeline hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency. Different Architectures: VLIW Architecture, SoC architecture. (12 hours)

Text/Reference Books:

1. V.CarlHammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, "Computer System Architecture", Edition
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition

6. John P. Hayes, “Computer Architecture and Organization”, PHI, Second edition.
7. P. Barry and P. Crowley, “Modern Embedded Computing”, Morgan Kaufmann, 2012.
8. B. Govindarajalu, “IBM PC and Clones”, Tata McGraw Hill, 1991.
9. William Stallings, “Computer Organization and Architecture: Designing for Performance”, 10th Edition by Pearson Education.
10. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by Elsevier.
11. Vincent P. Heuring and Harry F. Jordan, “Computer System Design and Architecture”, 2nd Edition, Pearson Education.

CSPCT407Computer Organization and Architecture	PO1	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3

MCHST408 Management Science

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Objectives of the course: To expose the students to the following:

Course Outcomes: At the end of this course, student will demonstrate the ability to

1. Work more creatively, work in groups
2. Presenting ideas more effectively and efficiently in formal and informal ways.
3. Development of fundamental rethinking and radical redesign in the organizations.
4. Applying the ideas of the course to identifying and solving real world problems.
5. Development of Group Dynamic Skills

Unit -1

Concept of Management – Administration, Organization – Functions of Management, evolution of management thought – Organization, principles of organization – Types – Organization charts – Managerial objectives and social responsibilities.

Unit -2

Corporate planning – Mission, Objectives, and programs, SWOT analysis – Strategy formulation and implementation – Plant location and Plant layout concepts – Production control.

Unit -3

Human resources management – Manpower planning – Personnel management – Basic functions of personnel management job evaluation and merit rating – Incentive plans- Marketing, Functions of marketing.

Unit -4

Productivity - Batch and mass production – Work study – Basic procedure involved in method study - work measurement – Elements of cost – Methods of calculation of overhead charges – Depreciation

Unit -5

Network Analysis to project management – PERT/CPM – Application of network techniques to engineering problems. – Cost Analysis – Project crashing.

Texts/Reference Books:

1. Principles of Management by Koontz and O Donnel.
2. Industrial Engineering and Management by O.P.Khanna.
3. Marketing by Philips Kother
4. PERT/CPM by L.S.Srinath
5. Business policy by Gluck (TMH)

MCHST408 Management Science	P01	**PO2**	**PO3**	**PO4**	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO4	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO5	3	3	2	2	-	1	-	-	-	-	1	2	3	3
CO6	3	3	2	2	-	1	-	-	-	-	1	2	3	3

EEPCT501 Control Systems
(Common to EEE and ECE)
Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Outcomes: At the end of this course students will demonstrate the ability to
Characterize a system and find its study state behavior.
Investigate stability of a system its assessment for linear-time invariant systems using different tests.
Design various simple feedback controllers.
Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
Solve liner, non-liner and optimal control problems.

Unit-1
Introduction to control problem (10 hours):
Industrial Control examples, System Representation, Classification of systems, Feedback Control, Benefits of Feedback- Open-Loop and Closed-loop systems, Advantages and Disadvantages of control systems, Industrial Control examples.

Mathematical models of physical systems: Electrical, Mechanical and Electro-Mechanical, Transfer function models of linear time-invariant systems: Potentiometers, Synchros, LVDT, dc and ac servomotors, Tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems,, Block diagram algebra, Reduction techniques and Signal flow graph.

Unit-2
Time Response Analysis (10 hours):
Standard test signals, Time response of first and second order systems for standard test inputs.

Application of initial and final value theorem. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. Design specifications for second-order systems based on the time-response, Steady state errors and error constants, Performance specifications in time-domain error, Static and Generalized error constants, Concept of stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

Unit-3

Frequency-responseanalysis (8 hours):

Introduction to Frequency domain specifications -Relationship between time and frequency response, Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Performance specifications in frequency-domain, Frequency domain methods of design.

Unit4

Introduction to Controller Design (10 hours)

Compensation & their realization in time & frequency domain, Introduction to controllers (PI, PD, PID), Application of Proportional, Integral and Derivative Controllers, Need for Lead and Lag compensators, Applications of compensators, Comparison of controllers and compensators, Problems.

Unit-5

State variable Analysis(8 hours) :

Concepts of state, state variables, State space model for linear continuous time functions, Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability.

Text/Reference Books:

M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
B. C. Kuo, "Automatic Control System", Prentice Hall, Seventh edition, 1995.
K. Ogata, "Modern Control Engineering", Prentice Hall, second edition, 1991.
I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

EET 42:Control Systems	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**		**2**										
CO2		**2**	**3**					**2**						
CO3		**2**	**3**					**3**						
CO4		**2**						**2**				**2**		

ECPCT502ICApplications

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. To study the applications of IC 741 as Scalar, Voltage follower, Adder and Comparator
2. To study the applications of IC 741 as AC coupled amplifier, integrator and differentiator c
3. To study the rectifier circuits using operational amplifiers and precision diodes.
4. To study R-2R Ladder and Weighted resistor type DAC.
5. To study the astable operation using operational amplifier
6. To generate triangular and square waveforms using 741 IC and IC 8038
7. To study the voltage regulator using IC 723
8. To study an operational amplifier as LPF and BPF

Unit-1

Op-Amp Applications: Summer, Integrator, Differentiator, Analog computation, DC and AC amplifiers. Instrumentation amplifier, V to I and I to V converters, Precision rectifiers, Log and Antilog amplifiers, multiplier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Unit-2

Comparators and waveform generators: Comparator, Regenerative comparator, Astable and mono-stablemulti-vibratorsusing op-amp, Triangular wave generator, Sine wave generators using op-amp. IC waveform generator (8038).

Unit-3

Phase Locked Loops: PLL- introduction, block schematic, principles and description individual blocks, IC PLL (565), Voltage controlled oscillator (566), PLL applications- Frequency multiplication, Frequency translation, FM & FSK demodulation.

Voltage regulators: Series op-amp regulator, IC voltage regulators, 723 regulator, Switching regulators.

Unit-4

DigitalICs:Quad 2-input NAND gate (7400), quad 2-input NOR gate7402, quad 2-input NAND gate, open collector outputs7403, hex inverter7404, 7406hex inverter buffer/driver, 30 V open collector outputs, BCD to decimal decoder7442, BCD to 7-segment decoder/driver, 15 V open collector outputs7447 , dual 4-bit decade counters 7468, AND gated J-K master-slave flip-flop, asynchronous preset and clear7472, dual J-K flip-flop, preset and clear7476, quad 2-input XOR gate7486, decade counter (separate divide-by-2 and divide-by-5 sections) 7490, 4-bit binary counter (separate divide-by-2 and divide-by-8 sections) 7493, 4-bit shift register, dual asynchronous presets 7494, dual 4-bit latch, clear 74116 , quad 2-input NAND Schmitt trigger74132, 3 to 8-line decoder/demultiplexer, inverting outputs74138, dual 2 to 4-line decoder/demultiplexer, inverting outputs74139, 8-line to 3-line priority encoder74148, 8-bit parallel-out serial shift register, asynchronous clear74164 , octal transparent latch, three-state outputs74373 ICs and their applications

Unit-5

Data converter ICs: D/A characteristics, DAC ICs – Conversion errors – performance measurements, D/A converter lCs.A/D characteristics, conversion errors, A/D converter ICs.

D.Roy Choudary, ShailB.Jain, "Linear Integrated circuits", New Age International publishers, 2003.
RamakantA.Gayakward, "Op-amps and linear Integrated circuits", LPE, 4th edition, Pearson Education.
S.Salivahanan, V.S.KanchanaBhaaskaran "Linear Integrated circuits", TMH, 2008.
David A. Bell, "Operational amplifiers and Linear ICs", PHI, EEE, 1997.
J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
The Bipolar Microcomputer Components Data Book for Design Engineers, Second Edition, Texas Instruments, 1979.

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

CO1: Understand the operation of analog electronic circuit systems and their components.

CO2:demonstrate the use of analog circuit analysis techniques to analyze the operation and behavior of various analog integrated circuits.

CO3: design differential amplifier using operational amplifier

CO4: analyze stability of operational design differential amplifier using operational amplifier amplifiers

CO5: apply frequency compensation techniques for amplifiers

CO6: design the different waveform generators using operational amplifiers.

CO7: design linear applications circuits such as summer, integrator, and differentiator etc using op-amplifiers.

CO8: design circuits such as log, comparator and multiplier etc using operational amplifiers.

CO9: analyze basic operation of PLL.

CO10: implement various applications of PLL

CO11: design and realize voltage regulators

CO12: realize analog filter circuits

ECT11 Analog IC Applications	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO 12**	**PSO 1**	**PSO2**
CO1	3	3	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	**3**	**1**	-	-	-	-	-	-	-	-	-	-
CO4	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	1	-	-	-	-	-	-	-	-	-	-
CO6	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-
CO7	-	-	**3**	**1**	-	-	-	-	-	-	-	-	-	-
CO8	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
CO9	3	3	-	1	-	-	-	-	-	-	-	-	-	-
CO10	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-
CO11	-	-	**3**	**1**	-	-	-	-	-	-	-	-	-	-
CO12	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-

ECPCP503IC ApplicationsLaboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT502.

1.To study the applications of IC 741 as Scalar, Voltage follower, Adder and Comparator

2. To study the applications of IC 741 as AC coupled amplifier, integrator and differentiator c

3. To study the rectifier circuits using operational amplifiers and precision diodes.

4. To study R-2R Ladder and Weighted resistor type DAC.

5. To study the astable operation using operational amplifier

6. To generate triangular and square waveforms using 741 IC and IC 8038

7. To study the voltage regulator using IC 723

8.To study an operational amplifier as LPF and BPF

ECPCP503: IC Applications Laboratory	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**3**	**3**	**3**		**3**		**2**				**3**		
CO2														
CO3														
CO4	**2**	**3**		**3**		**3**		**2**				**3**		

ECPCT504Microcontrollers

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Unit-1

Overview of microcomputer systems and their building blocks, Introduction to 8-bit microprocessor (8085) Architecture, Addressing modes, Instruction set, Machine cycles, instruction cycle and timing states, instruction timing diagrams, simple programs in 8085.

Unit-2

Semiconductor memories: RAM, ROM, SRAM, and DRAM. Memory interfacing, concepts of interrupts and Direct Memory Access.

I/O Interfacing with peripherals: Timer, serial I/O, parallel I/O, A/D and D/A converters, Arithmetic Coprocessors, System level interfacing design.

Unit-3

8051 Microcontroller: Architecture, Register set, Addressing modes, Instruction set, Interrupt structure, timer and serial port operations, Memory and I/O interfacing, External memory interfacing with 8051. Assembly language programming of 8051, Parallel I/O Ports, Interrupts, Timer and Counter, Serial

Communication Programming.

Unit-4

Synchronous and Asynchronous Communication, RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.Interfacing of 8051 microcontroller with LED, LCD, keyboard, Stepper motor, DC Motor, and sensors etc., C language programs, Assemblers and compilers, Programming and debugging tools.

Unit-5

Introduction to RISC processors, ARM7 Processor: Architecture, Features, ARM microcontrollers interface designs.

Concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 8086, 286, 386, 486, Pentium.

Text/Reference Books:

R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.

D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface", Morgan Kaufman Publishers.

Douglas V. Hall, "Microprocessors and interfacing: Programming and hardware", 2nd Edition. Tata McGraw Hill, 1991.

Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International Publishing/ Thomson Publishers,2nd Edition, 2005.

Barry B.Brey, The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Prentice Hall of India Private Limited, New Delhi, 2003/ Pearson Education , 2004. (UNIT V).

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Do assembly language programming.
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers.
4. Understand RSIC processors and design ARM microcontroller based systems

ECPCT504Microcontrollers	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1	–	2	–	–	2	–	–	–	–	–	–	–	–
CO2	–	2	–	1	–	2	–	–	–	–	–	–	–	–
CO3	–	2	2	1	–	2	–	–	–	–	–	–	–	–
CO4	–	2	2	1	–	2	–	–	–	–	–	–	–	–

ECPCP505Microcontroller Laboratory	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**	
Hands-on experiments related to the course contents ECPCT504.	

EECPCP505Microcontroller Laboratory	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**3**	**3**	**2**						**2**				
CO2	**3**	**3**	**3**	**2**						**2**				
CO3	**3**	**3**	**3**	**2**						**2**				

ECPCT506Digital Signal Processing	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

Course objectives:

1. The objective of this course is to provide fundamental knowledge of Digital signal processing techniques and applications.
2. To study DFT and implementation of DFTs using Fast Fourier Transform.
3. To understand the various realizations of filters, algorithms for calculating transform.
4. Provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
5. To understand concepts of sampling rate conversion and its applications.

Unit -1

Discrete Fourier series:

Review of Discrete-time Fourier Transform, Z-Transform. Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transform - Properties, linear convolution of sequences using DFT, computation of DFT. Relation between Z-Transform and DFS.

Fast Fourier Transforms: Fast Fourier transforms (FFT)-Radix2 decimation in time and decimation in frequency FFT algorithms, inverse FFT and FFT for composite N.

Unit-2

Realization of Digital Filters:

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

Unit-3

IIR Digital Filters: Analog filter approximations-Butterworth and chebyshev, design of IIR digital filters from analog filters, design examples: analog-digital transformations.

FIR Digital Filters: Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques, frequency sampling technique, comparison of IIR and FIR filters.

Unit -4

Multirate Digital Signal Processing Fundamentals: Basic sample rate alteration devices, Multirate Structures for sampling rate Converters, Multistage design of decimator and Interpolator, Polyphase Decomposition, Nyquist filters.

Unit -5

DSP PROCESSORS: TMS 320X/ ADSP 21XX Architecture and Applications.

Text Books

John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing:Principles, Algorithms and Applications", Pearson Education/PHI, 4th ed., 2007.

Sanjit K Mitra, "Digital Signal Processing:A computer based approach", Tata Mcgraw Hill, 3rd edition, 2009.

A.V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", Prentice Hall of India.

B.Venkataramani, M.Bhaskar,Digital Signal Processors: Architecture, Programming and Applications, Tata McGraw Hill, 2002.

Handouts on DSP Processors.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain.
2. Get the response of an LSI system to different signals.
3. Design of different types of digital filters for various applications.

ECPCT506Digital Signal Processing	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**3**	**2**							**3**		**3**		
CO2	**3**							**2**						
CO3	**3**													

ECPCP507Digital Signal Processing Laboratory	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**	

Course objective

1. To understand the convolution and its application in system analysis
2. To design IIR filter and FIR filter
3. To understand DFT of given sequence using FFT algorithm
4. To understand relationship between correlation and power spectral density

List Of Experiments:

PART A

1. (a) Generation of different waveforms (b) Generation of different discrete time sequence.
2. Compare Linear and Circular Convolutions.
3. DFT and IDFT
4. Frequency response of different analog filters.
5. Design FIR Filters (Low Pass, High Pass and Band Pass).
6. Design FIR Low Pass Filter using different Window Techniques.
7. Design Butterworth Filter (Low Pass and High Pass).
8. Design Chebyshev type I and type II Filters.
9. Conversion of Analog Filters into Digital Filters using
   (a) Impulse Invariant Transformations. (b) Bilinear Transformations.
10. Interpolation and Decimation of Sequence.
11. Power Spectral Density.

PART B (CC Studio)

1. Linear Convolution
2. Circular Convolution
3. DFT
4. FFT Algorithms

Density Spectrum of 1D Signal.

Course Outcomes: At the end of the course the student will be able to

CO1: Should able to find the convolution of sequence

CO2: Able to design IIR and FIR filter

CO3: Able to interrelate correlation and power spectral density

ECP11 DIGITAL SIGNAL PROCESSING LAB	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	2	1	-	-	-	-	-	1	-	3	
CO2	-	-	3	2	1	-	-	-	-	-	1	-	3	
CO3	-	-	3	2	2	-	-	-	-	-	1	-	3	

ECPET508Electronic Measurements

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives

1. To understand the different types of errors in the measurement process.
2. To understand the operating principles and design of DC ammeters, voltmeters and ohm meters.
3. To understand the internal diagrams of different types AC voltmeters.
4. To understand the internal diagrams of CRO.
5. To design the electrostatic deflection systems.
6. To understand working of special purpose oscilloscopes.
7. To design various instruments like electronic voltmeters, Q-meters and Multimeters.
8. To design different devices like DC and AC bridges, wave analyzers and spectrum analyzers.
9. To understand &design of various digital devices like digital volt meters, universal counters, etc.
10. To understand the selection of a transducer for measurement of physical parameters like displacement, pressure, temperature, strain etc.

UNIT-I

Measurement and Error: Definitions, accuracy and precision, types of errors. DC Ammeters, DC Voltmeters, Series type ohmmeter, Shunt type ohmmeter. AC Voltmeter using rectifiers, True RMS responding voltmeter.

UNIT-II

Cathode Ray Oscilloscopes : Motion of electron in electric field and in magnetic field – Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CROs – Measurements with CRO (voltage, current, time, frequency, phase angle, lissajous figures).

UNIT-III

Analog Instruments – Transistor voltmeter, micro voltmeter (chopper type) - DC differential voltmeter - AC voltmeters - Multimeter - Q meter and measurement methods.

Bridges: Wheatstone, Maxwell, Hay and Schering bridges.

Wave analyzers (AF & RF) - Harmonic distortion analyzers – Spectrum analyzer.

UNIT-IV

Digital instruments – Digital voltmeters(Ramp, Dual slope, stair case, successive approximation types) Digital multimeter, universal counter, Digital tachometer, Digital phase meter IEEE 488 Bus.

UNIT-V

Transducers – Classification and selection of transducers – strain gauges – Temperature measurement (resistance thermometer, thermo couples and thermisters) LVDT – Peizo electric transducer.

Text / References Books:

H.S.Kalsi, “Electronic Instrumentation” TMH, 1995.
Helfricand Cooper, “Modern Electronic Instrumentation and measurement techniques”, PHI, 1995.
A.K.Sawhney , " Electrical and electronic measurements and instrumentation", DanapatRai& Co.,18th edition., 2007.

CO1: demonstrate the importance of various errors in the measurement process.
CO2: design of various devices like DC Ammeter and DC voltmeters using PMMC, ohmmeters.
CO3: demonstrate internal structure, working and design of various electronic devices like true RMS responding voltmeters, AC voltmeters.
CO4: demonstrate internal structure, working and design of various subsystems in CRO.
CO5: design electrostatic deflection systems.
CO6: understand the working principles of special purpose oscilloscopes.
CO7: design different electronic devices like Multimeters and Q-meters, etc.
CO8: design DC and AC bridges.
CO9: understand audio & radio frequency wave analyzers and spectrum analyzers.
CO10: understand the working of different Digital voltmeters.
CO11: understand the working of different digital instruments like universal counter, tachometers etc.
CO12:select a transducer for measurement of various physical parameters like displacement, pressure, temperature, strain etc.

ECPET508: Electronic Measurements	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**3**	**2**	**2**								**3**		
CO2	**3**		**2**									**3**		
CO3	**3**			**3**						**2**		**3**		
CO4	**3**											**3**		

ECPET509 Program Elective – I	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECPET510 Program Elective – II	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECPCT601Computer Networks

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

1. To provide an introduction to networking technologies and understand fundamentals underlying the principles of computer networking and functionality of layered network architecture.
2. To make students to get familiarized with different topologies, transmission media, protocols and network components.
3. Understand the Concepts of Routing and Congestion Control Algorithms.
4. Acquire knowledge of the functions of different layers in OSI, TCP/IP Model In addition to explaining concepts, the course uses a multitude of real world examples of networking issues.
5. Understand how the packets are passed around the Internet and how the traffic and errors are controlled and to describe application and application protocols.

Unit -1

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit -2

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connectionoriented transport – Transmission Control Protocol, Remote Procedure Call.

Unit -3

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit -4

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Unit -5

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, and Switches.

Text /Reference books:

J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition

L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.

T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall

S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education

BehrouzA. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition

Andrew Tanenbaum, "Computer networks", Prentice Hall

D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall

William Stallings, "Data and Computer Communication, 8th Edition, Pearson Prentice Hall India.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understand the concepts of networking thoroughly.
2. Design a network for a particular application.
3. Analyze the performance of the network.

ECPCT601Computer Networks	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**3**	**2**		**2**								
CO2		**2**	**3**											

CO3				2		2								

ECPCP602Computer Networks Laboratory	
Instruction : Hours/Week : **0L:0T:4P**	**Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**	
Hands-on experiments related to the course contents ECPCT601.	

ECPCP603Electromagnetic Waves and Microwaves Lab	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**	
Hands-on experiments related to the course contents **ECPCT303**and ECPEL 03.	

ECPCP604Electronics Measurement Lab

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course objectives:

1. To understand the definitions, characteristics of instrumentation and measurements.
2. To calibrate different types of meters.
3. To understand the function of bridges.
4. To study the characteristics of transducers and its functions.

To get acquitted with the usage of special purpose instruments.

List of Experiments:

Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge).
Designing AC bridge Circuit for capacitance measurement.
Designing signal Conditioning circuit for Pressure Measurement.
Designing signal Conditioning circuit for Temperature Measurement.
Designing signal Conditioning circuit for Torque Measurement.

Designing signal Conditioning circuit for Strain Measurement.
Experimental study for the characteristics of ADC.
Experimental study for the characteristics of DAC.
Error compensation study using Numerical analysis using MATLAB (regression)

Course Outcomes: At the end of this course students will demonstrate the ability to
Design and validate DC and AC bridges
Analyze the dynamic response and the calibration of few instruments
Learn about various measurement devices, their characteristics, their operation and their limitations
Understand statistical data analysis
Understand computerized data acquisition.

ECPCP604Electronics Measurement Lab	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	1	3	-	3	-	1	3	2	3	3	2
CO2	3	3	1	3	3	2	2	-	3	2	1	3	3	1
CO3	2	1	1	-	3	2		3	3	2	3	2	1	1
CO4	1	1	1	-	1	2	3	3	3	1	3	1	1	1

ECPJP605Electronic Design Workshop /Mini Project

Instruction : Hours/Week : **0L:0T:4P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

Guidelines:
The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
Mini Project should cater to a small system required in laboratory or real life.
It should encompass components, devices, analog or digital ICs, micro controller with which

functional familiarity is introduced.
After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
The student is expected to exert on design, development and testing of the proposed work as per the schedule.
Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
Design, implement and test the prototype/algorithm in order to solve the conceived problem.
Write comprehensive report on mini project work.

ECPCP604Electronics Measurement Lab	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	1	3	-	3	-	1	3	2	3		
CO2	1	3	1	3	3	2	2	-	3	2	1	3		
CO3	1	1	1	-	3	2	1	3	3	2	3	3		

ECPET606Program Elective - III
Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

ECPET607Program Elective - IV
Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

ECPET608Program Elective - V	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECOET609 Open Elective-I	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECPET 701Program Elective-VI	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECPET 702Program Elective -VII	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECOET 703Open Elective-II	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

HSMCT704Total Quality Management	
Instruction : Hours/Week : **4L:0T:0P**	**Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**	
Course Objectives: To facilitate the understanding of total quality management principles and processes **Course Outcomes:** Upon completion of this course, the students will be able to use the tools and techniques of TQM in manufacturing and service sectors.	
Unit -1 Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention, costs to quality.	

Unit -2
TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement, PDCE cycle, 5S, Kaizen, Supplier partnership, Partnering, Supplier rating & selection.

Unit -3
The seven traditional tools of quality, New management tools, Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.

Unit -4
TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function, TPM- concepts, improvement needs, performance measures.

Unit -5
Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000-concepts, requirements and benefits, TQM implementation in manufacturing and service sectors.

Text/Reference Books:

Besterfield D.H. et al., Total Quality Management, 3rd ed., Pearson Education Asia, 2006.
Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.
Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.
Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.

HSMCT704Total Quality Management	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1	1	-	-	3	-	3	-	1	1	2	3		

ECPSI 705Summer Industry Internship / Mini Project

Instruction : Hours/Week : **4 to 6 weeksCredits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

ECPJP 706 Project –I

Project Work – I

Instruction : Hours/Week : **0L:0T:10P** **Credits: 5**
Sessional Marks : **40** End Semester Examination Marks: **60**

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a

good initiation for the student(s) in R&D work. The assignment to normally include:
1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee.

ECOET801Open Elective-III	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECOET802Open Elective-IV	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**	

ECPJP803 Project –II	
Project Work –II& Dissertation	
Instruction : Hours/Week : **0L:0T:18P**	**Credits: 9**
Sessional Marks : **40** End Semester Examination Marks: **60**	

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under **ECPJP 706 Project –I**, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:
1. In depth study of the topic assigned in the light of the Report prepared under ECPJP **706 Project –I**.
2. Review and finalization of the Approach to the Problem relating to the assigned topic.
3. Preparing an Action Plan for conducting the investigation, including team work.
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
5. Final development of product/process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/Publication in Journals, if possible.
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Project based – Science., Technology, Social, Design & Innovation

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to

direct it to exploration and sustained pursuit by the student which may result in development of a working system, a prototype, or a device or material, etc. They are not required or even expected to produce research or an innovation.

Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this (a) Exposure to social problems (which are amenable to technological solutions) (b) Design & Innovation (to address above problems).

After this students shall be encouraged to undertake technology projects of social relevance.

ECPJP 706 Project –I	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1	1	-	-	3	-	3	-	1	1	2	3		

ProfessionalElective Courses

ECPEL01	**Pulse and Digital Circuits**	**3L:0T:0P**	**3 credits**

Course objectives:

1. To understand basic principles involved in generation and processing of pulse waveforms.
2. To understand basic principles & design of diode clippers and clampers circuits.
3. To design different multivibrators using BJT's, JFET's, MOSFET's and CMOS.
4. To design time base generators for different frequencies & also methods to improve their sweep linearity.
5. To understand & design of Monostable and Astablemultivibrators using 555 IC timer.
6. To understand different IC families and their advantages and to understand interfacing them.

Unit -1

Wave shaping circuits: Types of waveform, characteristics of pulse waveforms, RC low pass and high pass circuits, rise time, tilt, square wave testing of amplifiers, Diode as a switch, Diode clipper and clamper circuits.

Unit -2

Multivibrators : BJT switch and switching times, Inverter, JFET switch, MOSFET and CMOS switches, BJT Schmitt trigger, Bistable, Monostable and Astablemulti-vibrators using BJT & triggering methods.

Unit -3

Time Base circuits : General features of Time-base signal, Methods of generating time base wave form, Exponential sweep circuit, sweep circuit using UJT, sweep circuit using a transistor switch, a transistor constant-current sweep, Miller and Bootstrap time-base generators-basic principles, transistor Miller time-base generator, bootstrap time-base generator.

Unit -4

IC Timers and Multi-vibrators: CMOS multi-vibrators, integrated circuit TTL multi-vibrators, 555 timer, Astable and mono-stable modes, dual timer and its applications.

Unit -5

Digital Integrated circuits: Evaluation of ICs, Advantages and classification of ICs. Digital IC characteristics, Digital IC families. DTL, HTL, TTL, ECL, MOS, CMOS, I^2L and their comparison, Totem-pole, open collector and Tristate outputs, interfacing different logic types.

Text/Reference Books:

Pulse, Digital &Switching Waveforms- J.Millman, Herbert Taub and M.S.PrakashRao, Tata Mc-Graw Hill, 2nd Edition, 2007.
David a. Bell, "Solid state pulse circuits", Prentice Hall of India, 4th Edn, 2002.
A. Anand Kumar, "Pulse and Digital Circuits", Prentice Hall of India, 2nd Edn, 2009.
B.S.Sode, "Introduction to system design using ICs, Wiley Eastern

Course Outcomes: At the end of the course, students will demonstrate the ability to:
Design RC low pass and high pass circuits for different RC time constants.
Design of non-linear wave shaping circuits likediode clippers and clampers.
Design different multivibrators using transistors and understand their applications.
Design different triggering mechanisms.
Design UJT sweep circuits.

ECPEL01 Pulse and Digital Circuits	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	1-	1	-	-	2	1	1	1	3	1		
CO2	3	3	2	2	1	2	3	2	2	1	2	1		
CO3	3	2	2	2	2	3	2	-1	1	2	1	1		
CO4	3	2	1-	1	-	-	2	1	1	1	3	1		
CO5	3	3	2	2	1	2	3	2	2	1	2	1		

ECPEL02	Antennas and Propagation	3L:0T:0P 3 credits

Course objectives:

1. To strengthen the concepts of electromagnetic and create mathematical and analytical basis in the area of antennas and propagation
2. To develop the insight into radiation fundamentals and discuss the antenna performance parameters
3. To discuss current distribution along linear wire antennas and introduce concept of linear arrays and their patterns
4. To study the analysis of Traveling wave antennas
5. To discuss the mathematical models of surface wave and space wave propagation
6. To discuss the layers in ionosphere and mode of sky wave propagation

Unit -1

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop.

Unit -2

Aperture and Reflector Antennas: Huygens' principle, radiation from rectangularand circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Unit -3

Broadband Antennas: Log-periodic and Yagi-Uda antennas, frequencyindependent antennas, broadcast antennas.

Micro strip Antennas: Basic characteristics of micro strip antennas, feedingmethods, methods of analysis, design of rectangular and circular patch antennas.

Unit -4

Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, and synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Unit -5

Basic Concepts of Smart Antennas: Concept and benefits of smart antennas, fixedweight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGrawill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Outcomes: At the end of the course, students will demonstrate the ability to:
Understand the properties and various types of antennas.
Analyze the properties of different types of antennas and their design.
Operate antenna design software tools and come up with the design of the antenna of required specifications.

ECPEL02 Antennas and Propagation	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	1-	1	-	-	2	1	1	1	3	1		
CO2	3	3	2	2	1	2	3	2	2	1	2	1		
CO3	3	2	2	2	2	3	2	-1	1	2	1	1		

ECPEL03	**Microwave Theory and Techniques**	**3L:0T:0P**	**3 credits**

Course objectives:

1. To study special purpose microwave Tube devises and its applications in transmitters and receivers.
2. To understand different semiconductor Microwave device characteristics , construction and applications.
3. To study different types of microwave components and their applications
4. To study different parameters and their measurements at MW frequencies
5. To study about Mw Integrated circuits and antennas used at MW frequencies.

Unit -1

Introduction to Microwaves: History of Microwaves, Microwave Frequency bands, Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission: Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Analysis of RF and Microwave Transmission Lines: Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis: Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.

Unit -2

Passive and Active Microwave Devices

Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator.

Microwave active components: Diodes, Transistors, Oscillators, Mixers.

Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Unit -3

Microwave Design Principles: Impedance transformation, Impedance Matching,Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas: Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Unit -4

Microwave Measurements: Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Unit -5

Microwave Systems: Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS.

Modern Trends in Microwaves Engineering: Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand various microwave system components their properties.
2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

ECPEL03 Microwave Theory and Techniques	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	2	1	2	3	2	-	1	1	1	-		
CO2	2	1	2	1	3	2	2	2	2	1	1	-		
CO3	3	2	2	2	3	1	3	2	3	2	1	-		

ECPEL04	**CMOS Design**	**3L:0T:0P**	**3 credits**

Course objectives:

1. To provide the basic fundamentals of fabrication technology, generations of IC and speed,

power consumptions of various fabrication technologies.

2. To understand the knowledge of electrical properties of MOS circuits.
3. To learn the design concepts of stick diagrams, layouts for various MOS technologies.
4. To understand the concepts of design rules, scaling, subsystem design semiconductor IC design.
5. To understand the synthesis, simulation design verification tools, CMOS testing

Unit -1

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Brief Introduction to MOS, PMOS, NMOS, CMOS & BiCMOS technologies. Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, $\mathbf{I_{ds} - V_{ds}}$ relationships, MOS transistor threshold Voltage, Transistor as a switch, Inverter characteristics.

Unit -2

Integrated Circuit Layout:VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for CMOS Inverters and Gates, Scaling of MOS circuits.

Basic Circuit Concepts: Sheet Resistance R_s and its concepts to MOS, Area Capacitance calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

Unit -3

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic, Switch logic, Alternate gate circuits. Shifters, Adders, Parity generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multipliers, Counters, High Density Memory Elements.

Unit -4

Sequential Circuit Design: Static Circuits, Design of latches and Flip-flops.

Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

Unit -5

Physical Design: Floor-Planning, Placement, routing, Power delay estimation, Clock and Power routing.

Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

Text/Reference Books:

N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.

C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

John M. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

Jacob Backer, Harry W. Li and David E. Boyce, "CMOS Circuit Design, Layout and Simulation ", Prentice Hall of India, 1998.

Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition.

Course Outcomes: At the end of the course the students will be able to

1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

ECPEL04 CMOS Design	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2

CO1	3	2	2	3	1	2	3	2	1	2	1	1		
CO2	3	2	1	2	2	1	1	2	3	1	2	1		

ECPEL05	Information Theory and Coding	3L:0T:0P	3 credits

UNIT I : INFORMATION ENTROPY FUNDAMENTALS
Uncertainty, Basics of information theory, Entropy for discrete ensembles, Source coding Theorem , Huffman coding, Shannon Fano coding, Discrete Memory less channels, channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II : DATA AND VOICE CODING
Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub-band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III : ERROR CONTROL CODING
Techniques of coding and decoding, Huffman codes and uniquely detectable codes, Linear Block codes , Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional arithmetic codes.

UNIT IV : COMPRESSION TECHNIQUES
Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V : AUDIO AND VIDEO CODING
Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

Text/Reference Books:
Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.
Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002.
Mark Nelson, “Data Compression Book”, BPB Publication 1992.
Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.
N. Abramson, Information and Coding, McGraw Hill, 1963.
M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
R.B. Ash, Information Theory, Prentice Hall, 1970.
Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
Understand the concept of information and entropy.
Understand Shannon’s theorem for coding.
Calculation of channel capacity.
Apply coding techniques.

ECPEL05 Information Theory and Coding	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3		2								2		
CO2	3	3	2	2								2		
CO3	3	3										2		
CO4	3	3		2								2		

ECPEL06	Embedded Systems	3L:0T:0P	3 credits

UNIT-1

Introduction to Embedded Systems: Understanding the Basic Concepts, The Typical Embedded System,Characteristics and Quality Attributes of Embedded Systems, Embedded microcontroller cores (hardware units and devices in a system), Embedded software in a system, Examples of embedded systems, Embedded system-on-chip (Soc), Design process in embedded systems, Formalization of embedded systems, Classification of embedded systems, Examples of embedded systems, Skills required for an embedded system designer.

UNIT-2

Technological aspects of embedded systems:

Power supply, clock, memory interface, interrupt, I/O ports, Buffers, Programmable Devices: FPGA, CPLD, ASICs etc., Interfacing with memory and I/O devices, Bus architectures like JTAC, I2C, SPI, AMBA, CAN etc., Embedded processor selection and trade-offs.

Hardware development cycles: Specifications, Component selection, Schematic Design, PCB layout, fabrication and assembly, testing – functional, manufacturing, parametric, Design tradeoffs due to process compatibility, thermal considerations, etc.

UNIT-3

High End RISC ARCHITECTURE ARM: Introduction to ARM processor, The ARM architecture , ARM

organization and implementation , The ARM instruction set , The thumb instruction set , Basic ARM Assembly language program, ARM CPU cores.

UNIT-4

Software aspects of embedded systems:

Concept of Firmware, Operating system basics, Device drivers, Real Time Operating System: Fundamentals, Multitasking application – Threads, execution suspension, sharing, resources between tasks: timers, message queues. Concurrent programming concepts – Tasks and Events: Synchronization and communication, task scheduling: Time slicing: priority: pre-emption scheduling interrupts and background tasks. Main features of QNX, Vx WORKS and LynxOS, Real Time Embedded System design and development.12

UNIT-5

Embedded System Design: Embedded System product Development Life cycle (EDLC), Product enclosure Design and Development, Embedded System Development Environment: IDE, Cross compilation, Simulators/Emulators, Hardware Debugging, Hardware testing methods like Boundary Scan, In Circuit Testing (ICT) etc.

Text/Reference Books:

Jonathan W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
Steave Furber, "ARM system on – chip architecture", Addison Wesley, 2000.
Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.
Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinley , "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education.
Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
David Simon, "An Embedded Software Primer", Perason Education, 2003.
Introduction to Embedded Systems – Shibu K.V, Mc Graw Hill.
F. Balarin et al., Hardware – Software Co-design of Embedded Systems: The POLIS approach, Kluwer, 1997

Course Outcomes: At the end of the course, students will demonstrate the ability to:

Learn basic of OS and RTOS and design embedded systems.
Suggest design approach using advanced controllers to real-life situations.
Design interfacing of the systems with other data handling / processing systems.
Understand embedded firmware design approaches.
Appreciate engineering constraints like energy dissipation, data exchange speeds etc.

ECPEL06 Embedded Systems	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**3**		**2**								**2**		
CO2	**1**	**2**	**2**	**2**								**2**		
CO3	**1**	**2**										**2**		
CO4	**1**	**1**		**2**								**2**		
CO5														

ECPEL07	Satellite Communication	3L:0T:0P	3 credits

Course objectives:

1. To provide an introduction to wireless communication, trends in wireless communications and cellular concept.
2. To make students to get familiarized mobile radio propagation models, parameters of mobile multipath propagation and fading.
3. Understand the Concepts of different modulation techniques and equalization.
4. To provide different coding and multiple access techniques for mobile communications.
5. To make the students to get familiarized with Mobile satellite systems and standards

Unit -1

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and

Sidereal day.

Unit -2

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit -3

Typical Phenomena in Satellite Communication:Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget.

Unit -4

Satellite link budget:Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Unit -5

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002.
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009.
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

ECPEL07 Satellite Communication	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**3**		**2**							**2**			
CO2	**1**	**2**	**2**	**2**							**1**			

CO3	1	2								2			

ECPEL08	Wireless Sensor Networks	3L:0T:0P	3 credits

Unit -1

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks,Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

Unit -2

Overview of sensor network protocols:Routing / Network layerprotocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, Fundamentals of IEEE 802.15.4, ZigBee, Bluetooth, BLE (Bluetooth low energy), and UWB, Dissemination protocol for large sensor network.

Unit -3

Data dissemination and processing:Data dissemination, data gathering, and data fusion, Quality of a sensor network,differences compared with other database management systems, data storage, query processing, Real-time traffic support and security protocols.

Unit -4

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication,Single-node architecture, Hardware components & design constraints.

Unit -5

Programming tools: Operating systems and execution environments, introduction to TinyOS,C, and nesC, Performance comparison of wireless sensor networks simulation.

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Text/Reference Books:

Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications, 2011.

Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009.

Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications, 2004.

Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science.

Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009.

H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.

Course Outcomes: At the end of the course the students will be able to

Design wireless sensor networks for different applications under consideration.

Understand emerging research areas in the field of sensor networks.

Understand MAC protocols used for different communication standards used in WSN.

Explore new protocols for WSN.

Handle special issues related to sensors like energy conservation and security challenges.

ECPEL08 Wireless Sensor Networks	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	3		2								2		
CO2	1	2	2	2								2		
CO3	1	2										2		
CO4	1	1		2								2		
CO5	2	3		2								2		

ECPEL 09	NEURAL NETWORKS AND FUZZY LOGIC	3L:0T:0P	3 credits

Unit – 1

Artificial Neural Networks: Introduction to neural networks, biological neurons, artificial neurons, McCulloch-Pitt's neuron model, neuron modeling for artificial neural systems, feed forward network, perceptron network, Supervised and un-supervised learning.

Learning Rules: Hebbian learning Rule, Perceptron learning Rule, Delta learning Rule, Winner-take-all learning rule, Out-star learning rule.

Unit – 2

Supervised Learning: Perceptrons, exclusive OR problem, single layer perceptron network, multi-layer feed forward networks: linearly non separable patter classification, delta learning rule for multi perceptron layer, error back propagation algorithm, training errors , ADALINE, introduction to Radial Basis Function Networks(RBFN).

Unit – 3

Un-Supervised Learning: Hamming net, Max net. Winner–take–all learning, counter propagation network, feature mapping, self-organizing feature maps

Applications of neural Algorithms: elementary aspects of applications of character recognition.

Neural Network control applications: Process identification, Basic dynamic learning control architecture.

Unit – 4

Fundamentals of fuzzy logic and fuzzy sets: Definition of fuzzy set , a-level fuzzy set , cardinality, operations on fuzzy sets: union, intersection, complement, Cartesian product, algebraic sum, definition of fuzzy relation, properties of fuzzy relations, fuzzy composition.

Unit – 5

Design of Fuzzy Systems: Components of fuzzy systems, functions of fuzzification, Rule base patterns, Inference mechanisms.

Methods of de-fuzzification: COG, COA, MOM, Weighted average, height methods, Design of Fuzzy Systems for temperature setting of water heater, fuzzy system for control of air conditioner.

Text / References Books:

S.Rajasekaran&G.A.VijayalakshmiPai, "Neural Networks, Fuzzy logic, and Genetic Algorithms", PHI, EEE, 2003.

FakhreddineO.Karrry&Clarance De Silva, " Soft Computing and Intelligent Systems, Design Theory, Tools and Applications", Pearson, 2009.

Jacek M Zurada, " Introduction to artificial Neural Systems", Jaico Publications.

Zimmerman, " Fuzzy Set Theory and its Applications" , Kluwer Academic Publishers.
Timothy J. Ross, " Fuzzy Logic with Engineering Applications" ,(McGrawHill).

Course Outcomes: After successful completion of the course, the student will be In a position to
Understand the Biological neural systems and construction of artificial neural systems.
Understand and explain different learning rules
Understand the concept of pattern classification.
Identify the different types of supervised and unsupervised training algorithms.
Have a detailed knowledge of the components of fuzzy logic system.
Design fuzzy logic system and will address the real time applications.

ECPEL 09 NEURAL NETWORKS AND FUZZY LOGIC ECPEL 10	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO2	**2**	**3**	**2**	**3**	**2**	**1**								
CO3	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO5	**2**	**3**	**2**	**3**	**2**	**1**								
CO6	**2**	**2**	**1**	**1**	**3**	**2**					**1**			

ECPEL 10	**Introduction to MEMS**	**3L:0T:0P**	**3 credits**

Unit -1
Introduction and Historical Background, Scaling Effects, Micro/Nano Sensors.
Unit -2
Actuators and Systems overview: Case studies.
Unit -3
Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.
Unit -4
Micromachining: Surface Micromachining, sacrificial layer processes, Stiction, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.
Unit -5
Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Text/Reference Books:
1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.

2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

ECPEL 10 Introduction to MEMS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**3**			
CO2	**2**	**3**	**1**	**2**	**2**	**3**	**1**	**2**	**1**	**2**	**2**			

ECPEL 11	**Fiber Optic Communication**	**3L:0T:0P**	**3 credits**

Unit -1
Overview of Optical Fiber Communication The evolution of fiber optic systems, elements of an optical fiber transmission link, block diagram, advantages of optical fiber communication, applications. Introduction to vector nature of light, propagation of light, Ray theory transmission, total internal reflection, acceptance angle, numerical aperture and skew rays, propagation of light in a cylindrical dielectric rod, Ray model, wave model., Modes, electromagnetic mode theory and propagation, single mode and multimode fibers, linearly polarized modes.
Unit -2
Different types of optical fibers, Fiber material, fiber cables and fiber fabrication, fiber joints, fiber connectors, splicer, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation, Fabrication of fibers and measurement techniques like OTDR.
Unit -3
Optical Sources and Detectors: Coherent and non-coherent sources, quantum efficiency, modulation capability of optical sources, LEDs: Working principle and characteristics, Laser diodes: Working principle and characteristics , Working principle and characteristics of Photo-detectors: PIN-diodes, APDs, detector responsivity, noise analysis in detectors, coherent and non-coherent detection, receiver structure, bit error rate of optical receivers, and receiver performance, Optical link design - BER calculation, quantum limit, power penalties.
Unit -4

Optical switches - coupled mode analysis of directional couplers, electro-optic switches.
Optical amplifiers - EDFA, Raman amplifier.

Unit -5

Optical Networks: SONET and SDH standards, architecture of optical transport networks (OTNs), network topologies, Operational principle of WDM and DWDM systems, WDM network elements and Architectures, Principles of WDM networks, Solutions.

Nonlinear effects in fiber optic links: Concept of self-phase modulation, group velocity dispersion and solution based communication.

Text/Reference Books:

J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
J. Gowar, Optical communication systems, Prentice Hall India, 1987.
S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Course Outcomes: At the end of the course, students will demonstrate the ability to:

Understand the principles fiber-optic communication, the components and the bandwidth advantages.
Understand the properties of the optical fibers and optical components.
Understand operation of lasers, LEDs, and detectors.
Analyze system performance of optical communication systems.
Design optical networks and understand non-linear effects in optical fibers.

ECPEL 11 Fiber Optic Communication	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO2	**2**	**3**	**2**	**3**	**2**	**1**								
CO3	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO5	**2**	**3**	**2**	**3**	**2**	**1**								

ECPEL 12	Digital Design through HDLs	3L:0T:0P	3 credits

Unit-1

VHDL Background: VHDL History, Existing Languages, VHDL Requirements, The VHDL Language. Design Methodology Based On VHDL: Elements of VHDL, Top down Design, Top down Design with VHDL, Subprograms, Controller Description, VHDL Operators, Conventions and Syntax. Basic Concepts In VHDL: Characterizing Hardware Languages, Objects and Classes, Signal Assignments, Concurrent and Sequential Assignments.

Unit-2

Design Organization and Parameterization: Definition and Usage of Subprograms, Packaging, Parts and Utilities, Design Parameterization, Design Configuration, Design Libraries. Utilities For High-Level Descriptions: Type Declarations and Usage, VHDL Operators, Subprogram Parameter Types and Overloading, Other Types and Type Related Issues, Predefined Attributes, User Defined Attributes.

Dataflow Descriptions In VHDL: Multiplexing and Data Selection, State Machine Description, Three State Bussing. Behavioral Description of Hardware: Process Statement, Assertion Statement, Sequential Wait Statements, Formatted ASCII I/O Operations, MSI Based Design. Implementation of Combinational and sequential circuits, Datapaths and control unit design , multiplier, ALU design

Unit-3

Verilog HDL: Overview of Digital design with Verilog HDL, Hierarchical modeling concepts, , Identifiers, operators, Data types, types of model, expressions, assignments, behavioral, Structural gate and switch level modeling, tasks and functions. Design using HDL- Adders, Multiplexers, decoders, Flip-flops, Counters, Shift registers, RTL coding guidelines , Coding organization and writing a test bench.

Unit- 4

Verification Basics: Technology challenges, Verification methodology options, Verification methodology, Test bench creation, test bench migration, Verification languages, Verification IP reuse, Verification approaches, Verification and device test, Verification plans, reference design of Bluetooth SoC, Verification Guidelines.

Unit-5

Testing & verification: Fault Modeling and Simulation, Functional testing, Design for testability-Scan based designs, Boundary scan standards (JTAG), Built in Self test (BIST).

Text/ Reference Books:

J. Bhaskar, “VHDL Primer”, Third Edition, Published by PHI Learning, 2009.
Chris Spear, “System Verilog for Verification: A guide to learning the testbench language features”, Springer, 2nd Edition
Stuart Sutherland, Simon Davidmann, and Peter Flake, “System Verilog for Design: A guide to using system verilog for hardware design and modeling”, Springer, 2nd Edition.
Samir Palnitkar Verilog HDL A Guide to Digital Design and Synthesis, By Publication: Pearson Education

List of Open Source Software/learning website:

1) www.xilinx.com, Xilinx project navigator evaluation tools version.
2) www.altera.com, Altera Quartus evaluation software tool.

Course Outcome: After learning the course the students should be able to:

Work with Hardware Descriptive Language like Verilog/VHDL.
Work with various EDA tools used in chip design process.
Work with EDA tools of VLSI.
Test and analysis of digital design on simulator that support HDL compiler.
Verification of soft code implemented in HDL through verification tools.
Implement various digital logic blocks on FPGA/CPLD boards.
System design and implementation on FPGA/CPLD boards.
Develop project based on FPGA/CPLD through HDL language.

ECPEL 12 Digital Design through HDLs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	2	1	1	3	2					1			
CO2	3	2	3	2	3		1			1	1	3		
CO3	2	3	2	3	2	1								
CO4	3	2	3	2	3		1			1	1	3		
CO5	2	3	2	3	2	1								
CO6	2	2	1	1	3	2					1			
CO7	3	2	3	2	3		1			1	1	3		
CO8	2	3	2	3	2	1								

ECPEL 13	Error Correcting Codes	3L:0T:0P	3 credits

Unit – 1

Mathematical Preliminaries: Introduction, Groups, Rings, Fields, Galois Fields(GF), Arithmetic of Galois Field, Integer Ring, Polynomial Rings, Polynomials and Euclidean algorithm, primitive elements, Construction and basic properties of Finite Fields, Computations using Galois Field arithmetic, sub fields, Minimal polynomial and conjugates, Vector space, Vector Subspace, Linear independence. (9 hours)

Unit – 2

Linear Block Codes: Block codes, Properties, Minimum Distance, Error detection and correction, Standard Array and Syndrome decoding, Hamming codes, Perfect and Quasi-perfect codes, Extended codes, Hadamard codes, Maximum likelihood decoding, Hard decision decoding and soft decision decoding. (10 hours)

Unit – 3

Cyclic Codes: Basic theory of cyclic codes, Generator and Parity check matrices , Encoding and Decoding of Cyclic codes, sequential decoding of convolutional codes, Error detection & correction, Cyclic Hamming codes,Binary Golay codes, Bose Chaudhury & Hocquenghem(BCH) codes, Decoding of BCH codes,The Berlekamp- Massey decoding algorithm, Euclids algorithm,Reed Solomon codes, Generalized Reed Solomon codes, MDS codes. (9 hours)

Unit – 4

Convolutional Codes: Generator matrices and encoding, state, tree and trellis diagram, Transfer function , Maximum Likelihood decoding Hard versus Soft decision decoding, The Viterbi Algorithm, Free distance, BCJR algorithm, FanoMetric, Stack Algorithm, Fano Algorithm decoding, Error Analysis of convolution codes, Puctured Convolution codes. Trellis Coded Modulation- Encoding and Decoding. (9 hours)

Unit – 5

Low-density Parity-check (LDPC) Codes: Constructing LDPC codes, Decoding of LDPC Codes, Hard and Soft decoders, Message-passing decoders, Threshold phenomenon and density evolution.
Soft Decision and Iterative Decoding: Soft decision Viterbi algorithm, two-way APP decoding.
Turbo codes: Turbo algorithm, convergence properties of the turbo algorithm, Distance properties of turbo codes. (9 hours)

Text / References Books:

L.H.Charles Lee, "Error – Control block codes for communication Engineers", Artech House, 2000.
L. H. Charles Lee, "Convolutional Coding: Fundamentals and Applications, Artech House, Boston
Shu Lin and Daniel J. Costello Jr., Error Control Coding: Fundamentals and applications", 2nd edition, Pearson, Prentice Hall, 2004.
W.C. Huffman and Vera Pless, "Fundamentals of Error correcting codes", Cambridge University Press, 2003.
Rolf Johannesson, Kamil Sh. Zigangirov, "Fundamentals of Convolutional Coding", Universities Press (India) Ltd. ,2001.
Ezio Biglieri – coding for wireless channels, Springer International edition (SIE), 2005.

Course Outcomes: After successful completion of the course, the student will be In a position to
Find solutions to the problems associated with Galois fields.
Acquainted with basic block codes, cyclic codes, convolutional codes and BCH codes.
Able to gain knowledge of hard decision, soft decision codes, Turbo codes and LDPC codes.
Easily differentiate the specific application of specific code.
Able to apply encoding techniques for Mobile applications and Space communication.

ECPEL 14	Mobile Communication and Networks	3L:0T:0P	3 Credits

Course objectives:

1. To provide an introduction to wireless communication, trends in wireless communications and cellular concept.
2. To make students to get familiarized mobile radio propagation models, parameters of mobile multipath propagation and fading.
3. Understand the Concepts of different modulation techniques and equalization.
4. To provide different coding and multiple access techniques for mobile communications.

To make the students to get familiarized with Mobile satellite systems and standards

Unit-1

Cellular Concept and System Design Fundamentals: Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications.
Cellular concepts: Cell structure, frequency reuse, cell splitting, channelassignment, handoff, interference, capacity, power control.

Wireless Standards: Overview of 2G and 3G cellular standards.

Unit-2

Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, inter system Handoff, Introduction to Dropped Call Rates and their Evaluation,Interference and system capacity, trunking and grade of service, Improving Coverage and capacity in Cellular systems.

Signal propagation: Propagation mechanism- reflection, refraction, diffraction andscattering, large scale signal propagation and lognormal shadowing.

Unit-3

Fading channels-Multipath and small scale fading: Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate, Capacity of flat and frequency selective channels.

Unit-4

Antennas: Antennas for mobileterminal- monopole antennas, PIFA, base station antennas and arrays.
Multiple access schemes: FDMA, TDMA, CDMA and SDMA.
Modulation schemes: BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Unit-5

Receiver structure: Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.
MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.**Performance measures**: Outage, average SNR, average symbol/bit error rate.
System examples: GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

ECPEL 14 Mobile Communication and Networks	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**1**	**2**	**1**	**3**	**2**	**3**	**1**	**1**	**1**	**3**		
CO2	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**1**						

CO3	1	2	2											
CO4		1	2	2	3									
CO5	2	2	1	2	1	3	2	3	1	1	1	3		

ECPEL 15	Nano Electronics	3L:0T:0P 3 credits

UNIT I: Introduction: Evolution of science and nanotechnology,Introduction to nanotechnology, Difference between Nanoscience and nanotechnology, Feynman predictions on nanotechnology ,Role of up and top down approaches in nanotechnology,challenges in nanotechnology. **(12Hrs)**

UNI2T II: Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope –scanning tunneling microscope – nanomanipulator – nanotweezers – atom manipulation – nanodots – self assembly – dip pen nanolithography.(12Hrs)

UNIT III: Nanopowders-Synthesis and processing of nanopowders-process for producing ultrafine powders-mechanical milling,wet chemical synthesis, gas condensation process, chemical vapour condensation, laser ablation, Design and synthesis of self assembled nanostructured materials. **(12Hrs)**

UNIT–IV:Nano Materials: History of Materials, Definition, classification of Nanostructured Materials, cause of interest in Nanomaterials,Nanomaterials preparation-present and future applications of Nanomaterials,special nanomaterials,characterization and tools: carbon nanotubes, nano composites, carbon fullerenes: An overview of preparation,properties,Electron microscopy techniques:scanning Electron Microscopy,Transmission Electron Microscopy,scanning probe Microscopy-X ray Methods**(12Hrs)**

UNIT-V: NanoElectronics-Introduction to micro, nano fabrication: optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy, MEMS-Introduction,principles,Types of MEMS:-Mechanical, Thermal, Magnetic MEMS, Fabrication of MEMS.

Text /Reference Books:

Nano Materials by A S Edelstein& R C Cammarata,Institutee of physics publishing,Bristic and Philadelphia

2.Nanotechnology by Mark Ratner &Danier Ratner ,Prentice Hall.

3.Micro Manufacturing and Nanoteecnology by N.P.Mahalik.

G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

K.E. Drexler, Nanosystems, Wiley, 1992.

E-resources and other digital material

nptel.iitm.ac.in/courses.php?branch=Ece , www.cdeep.iitb.ac.in

Course outcomes

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

Understand various aspects of nano-technology and the processes involved in making nano components and material.

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Understand various aspects of nano-technology and theprocesses involved in making nano components and material

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

ECPEL 15 Nano Electronics	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	2	1	1	3	2					1			
CO2	3	2	3	2	3		1			1	1	3		
CO3	2	3	2	3	2	1								
CO4	3	2	3	2	3		1			1	1	3		
CO5	2	3	2	3	2	1								

ECPEL 16	Scientific Computing	3L:0T:0P	3 Credits

Unit-1

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-2

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Unit-3

Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares.

Interpolation:Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation.

Unit-4

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems Partial Differential Equations,Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative

Methods

Unit-5

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets,Random Numbers and Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.

Text/ Reference Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002.
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008.
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006.
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB and Octave", Springer, 3rd Ed., 2010

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.

ECPEL 16 Scientific Computing	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**1**	**2**	**2**	**1**	**2**	**3**		**2**	**3**		
CO2	**1**	**2**	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**1**				

ECPEL 17	**Digital Image & Video Processing**	**3L:0T:0P**	**3 Credits**

Unit-1

Digital Image Fundamentals: Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Image Transforms: Introduction. ,Need for image transforms, Fourier transform, 2 D Discrete Fourier transform and its properties, Walsh transform, Hadamard transform, Haar Transform, slant transform, Discrete cosine transform , Karhunen-loeve transform transform, singular value Decomposition, Radon transform, comparison of different image transforms.

Unit-2

Image Enhancements and Filtering: Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain.

Sharpening filters: first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Image Segmentation: Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

Unit-3

Image compression : Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Losslesscompression – predictive, entropy; Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression. Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Unit-4

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening, Color Segmentation.

Video Processing: Video Formation, Perception and Representation, Video capture and display, Analog video raster, Analog color television systems, Digital video.

Unit-5

Fundamentals of Video Coding: Inter-frame redundancy, motion estimationtechniques – fullsearch, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation: Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Text/Reference Books:

R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.
S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata Mc Graw Hill publishers, 2009 .
Yao Wang,Jorn Ostermann and Ya Qin Zhang "Video processing and Communications" Prentice Hall Publishers, 2002, ISBN 0-13-017547-1.
nptel.iitm.ac.in/courses.php?branch=Ece
www.cdeep.iitb.ac.in

Course Outcomes: At the end of the course, students will demonstrate the ability to:
Mathematically represent the various types of images and analyze them.
Process these images for the enhancement of certain properties or for optimized use of the resources.
Develop algorithms for image compression and coding.
Apply basic operations on video and Estimate the motion of two dimensional video.

ECPEL 15 Nano	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS

Electronics	1	2	3	4	5	6	7	8	9	10	11	12	O1	O2
CO1	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO2	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO3	**2**	**3**	**2**	**3**	**2**	**1**								
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		

ECPEL 18	Bio-Medical Electronics	3L:0T:0P 3 credits

Unit-1

Brief introduction to human physiology.-Structure of cell – Function of each components of the cell – Membrane potential – Action potential – Generation and Conduction- Anatomy and Physiological aspects of respiration.

Unit-2

Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

Unit-3

Bio-electrodes and bio-potential amplifiers ---Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – non-polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes. Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, isolation amplifiers, Chopper amplifier.

Unit-4

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators, heart-lung machine, Artificial kidney, aids for the handicapped.

Unit-5

Safety aspects: – devices to protect against electrical hazards – Ground fault interrupter, isolation transformer, line isolation monitor, receptacle tester, electrical safety analyzer equipment, preventive maintenance.

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

ECPEL 15 Nano Electronics	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2

CO1	2	2	1	1	3	2					1			
CO2	3	2	3	2	3		1			1	1	3		
CO3	2	3	2	3	2	1								

ECPEL 19	Adaptive Signal Processing	3L:0T:0P	3 Credits

Unit -1

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit -2

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

Unit -3

Variants of the LMS algorithm: The sign LMS families, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Signal space concepts: introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Unit -4

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit -5

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
1. Understand the non-linear control and the need and significance of changing the control parameters with respect to real-time situation.
2. Mathematically represent the 'adaptability requirement'.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

ECPEL 15 Nano Electronics	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO2	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO3	**2**	**3**	**2**	**3**	**2**	**1**								

ECPEL 20	**Speech and Audio Processing**	**3L:0T:0P**	**3 credits**

Unit -1

Introduction- Speech production and modeling: Human Auditory System;General structure of speech coders, Classification of speech coding techniques: parametric, waveform and hybrid, Requirements of speech codecs: quality, coding delays, robustness.

Speech Signal Processing: Pitch-period estimation, all-pole and all-zero filters,convolution, Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Unit -2

Linear Prediction of Speech: Basic concepts of linear prediction, LinearPrediction Analysis of non-stationary signals: prediction gain, examples, Levinson-Durbin algorithm, Long term and short-term linear prediction models; Moving average prediction.

Unit -3

Speech Quantization:**Scalar quantization**: uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers.
Vector quantization: distortion measures, codebook design, codebook types.

Scalar Quantization of LPC: Spectral distortion measures, Quantization based onreflection coefficient

and log area ratio, bit allocation, Line spectral frequency: LPC to LSF conversions, quantization based on LSF.

Unit -4

Linear Prediction Coding: LPC model of speech production, Structures of LPCencoders and decoders, Voicing detection, Limitations of the LPC model.

Code Excited Linear Prediction: CELP speech production model, Analysis-by-synthesis, Generic CELP encoders and decoders.

Unit -5

Excitation codebook search: state-save method, zero-input zero-state method, CELP based on adaptive codebook, Adaptive Codebook search, Low Delay CELP and algebraic CELP.

Speech Coding Standards: An overview of ITU-T G.726, G.728 and G.729standards.

Text / Reference Books:

1. A.M.Kondoz, "Digital Speech" Second Edition (Wiley Students Edition), 2004.
2. W.C. Chu, "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", WileyInter science, 2003.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal.
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

ECPEL 20 Speech and Audio Processing	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO2	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO3	**2**	**3**	**2**	**3**	**2**	**1**								
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		

ECPEL 21	Wavelet Theory and Applications	3L:0T:0P 3 credits

Unit I - Introduction:
Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Wigner-Ville transform, Time-frequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

Unit II -Continuous Wavelet Transform:
Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain.

Unit III - Discrete Wavelet Transform and Filterbanks:
Orthogonal and biorthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

Unit IV - Multi Resolution Analysis:
Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packet analysis, Construction of wavelets.

Unit V - Applications:
Signal and Image compression, Detection of signal changes, analysis and classification of audio signals using CWT, Wavelet based signal de-noising and energy compaction, Wavelets in adaptive filtering, Adaptive wavelet techniques in signal acquisition, coding and lossy transmission, Digital Communication and Multicarrier Modulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

Text/Reference Books:

A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press, 1999.
M. Vetterli and J. Kovacevic, Wavelets and Sub band Coding, Prentice Hall, 1995.
Raghuveer rao and Ajit S.Bopardikar, Wavelet transforms: Introduction, Theory and applications, Pearson Education Asia, 2000.
J.C. Goswami and A.K. Chan,Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd ed., Wiley, 2011.
Michel Misiti, Yves Misiti, Georges Oppenheim, Jean Michel Poggi, Wavelets and their Applications, John Wiley & Sons, 2010 .
J S Walker,A premier on Wavelets and their scientific applications, CRC press, 2002.
Stark, Wavelets and signal processing: An application based introduction, Springer, 2005.
Gerald keiser, A friendly guide to Wavelets, Springer, 2011.
P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2004.
Desanka.P.Radunovik,Wavelets: from math too practice, Springer, 2009.
K P Soman and KL Ramachandran, Insight into wavelets from theory to practice, PHI, 2008.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
1. Understand time-frequency nature of the signals.
2. Apply the concept of wavelets to practical problems.
3. Mathematically analyze the systems or process the signals using appropriate wavelet functions.

ECPEL 21 Wavelet Theory and Applications	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO2	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO3	**2**	**3**	**2**	**3**	**2**	**1**								

ECPEL 22	**Machine learning**	**3L:0T:0P**	**3 credits**

COURSE OBJECTIVES:
To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
Explore supervised and unsupervised learning paradigms of machine learning.
To explore Deep learning technique and various feature extraction strategies.

Unit 1:
Supervised Learning (Regression/Classification)
Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes.
Linear models: Linear Regression, Logistic Regression, Generalized Linear Models
Support Vector Machines, Nonlinearity and Kernel Methods.
Beyond Binary Classification: Multi-class/Structured Outputs, Ranking. 10

Unit 2
Unsupervised Learning
Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA
Matrix Factorization and Matrix Completion
Generative Models (mixture models and latent factor models). 7
Unit 3
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests.) 6
Unit 4
Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning. 9
Unit 5
Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference Recent trends in various learning techniques of machine learning and

classification methods for IOT applications, Various models for IOT applications. 14
Text / References Books: Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online) Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
Course Outcomes: After completion of course, students would be able to: Extract features that can be used for a particular machine learning approach in various IOT applications. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach. To mathematically analyze various machine learning approaches and paradigms.

ECPEL 22 Machine learning	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**1**		
CO2		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**				
CO3	**2**	**3**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**			

ECPEL 23	**Power Electronics**	**3L:0T:0P**	**3 credits**

Unit -1

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit -2

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit -3
Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit -4
Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Unit -5
Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:
1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
3. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
4. V.R.Moorthi, "Power Electronics", Oxford University Press.
5. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

Course Outcomes: At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR.
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters.
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

ECPEL 23 Power Electronics	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**2**	**1**	**1**	**3**	**2**					**1**			
CO2	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO3	**2**	**3**	**2**	**3**	**2**	**1**								
CO4	**2**	**2**	**1**	**1**	**3**	**2**					**1**			

ECPEL 24	**Mixed Signal Design**	**3L:0T:0P**	**3 credits**

Unit -1
Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Unit -2
Switched-capacitor filters: Non-idealities in switched-capacitor filters, Switched-capacitor filter architectures, Switched-capacitor filter applications.
Unit -3
Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Unit -4
Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Unit -5
Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs, Digital PLLs, DLLs.

Text/Reference Books:
1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008. 4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

Course Outcomes: At the end of the course, students will demonstrate the ability to:
1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals.

ECPEL 24 Mixed Signal Design	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO2	**2**	**3**	**2**	**3**	**2**	**1**						**2**		
CO3	**2**	**2**	**1**	**1**	**3**	**2**					**1**	**2**		
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		

ECPEL 25	High Speed Electronics	3L:0T:0P	3 credits

Unit -1

Transmission line theory (basics) crosstalk and non-ideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation, Cross-modulation, Dynamic range.

Unit -2

Devices: Passive and active, Lumped passive devices (models), Active (models, low vs highfrequency).

Unit -3

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion, Efficiency.

Unit -4

RF power output stages Mixers –Up conversion Down conversion, Conversion gain and spurious response, Oscillators Principles, PLL Transceiver architectures.

Unit -5

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards, Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399.
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5. Kai Chang, "RF and Microwave Wireless systems", Wiley. 6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics.
3. Design High-speed electronic system using appropriate components.

ECPEL 24 Mixed Signal Design	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	2	1	1	3	2					1			
CO2	3	2	3	2	3		1			1	1	3		
CO3	2	3	2	3	2	1								

ECPEL 26	Internet of Things and Applications	3L:0T:0P	3 credits

Course Outcomes: At the end of this course, students will be able to
Understand the concept of IOT and M2M

Study IOT architecture and applications in various fields
Study the security and privacy issues in IOT.

Syllabus Contents:

Unit 1

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

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

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues,Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

Text / Reference Books:

Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1stEdition, Apress Publications, 2013.
CunoPfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.

ECPEL 26 Internet of Things and Applications	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	2	1	1	3	2					1			
CO2	3	2	3	2	3		1			1	1	3		
CO3	2	3	2	3	2	1								

GATE 2018 Syllabus

EC Electronics and Communications Engineering

Section 1: Engineering Mathematics

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Vector Analysis: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems.

Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.

Numerical Methods: Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria.

Probability and Statistics: Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions - binomial, Poisson, exponential and normal; Joint and conditional probability; Correlation and regression analysis.

Section 2: Networks, Signals and Systems

Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; **Discrete-time signals**: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

Section 3: Electronic Devices

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Section 4: Analog Circuits

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and opamp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Section 5: Digital Circuits

Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders and PLAs;

Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; **Semiconductor memories**: ROM, SRAM, DRAM; **8-bit microprocessor (8085):** architecture, programming, memory and I/O interfacing.

Section 6: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

Section 7: Communications

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems;

Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, circuits for analog communications;

Information theory: entropy, mutual information and channel capacity theorem;

Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

Section 8: Electromagnetics

Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; **Transmission**

lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; **Waveguides**: modes, boundary conditions, cut-off frequencies, dispersion relations; **Antennas**: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.

Open Electives Courses –from other technical and /or emerging subjects

OEC-EC02	**Microprocessors and Interfacing**	**3L:0T:0P**	**3 credits**

UNIT-1
Overview of microcomputer systems and their building blocks, Introduction to 8-bit microprocessor (8085) Architecture, Addressing modes, Instruction set, Machine cycles, instruction cycle and timing states, instruction timing diagrams, simple programs in 8085. (8 Hours)

UNIT-2
Semiconductor memories: RAM, ROM, SRAM, and DRAM. Memory interfacing, concepts of interrupts and Direct Memory Access.
I/O Interfacing with peripherals: Timer, serial I/O, parallel I/O, A/D and D/A converters, Arithmetic Coprocessors, System level interfacing design. (10 Hours)

UNIT-3
The 8051 8-bit microcontroller Architecture, ALU, address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Addressing Modes, Data types, 8051 Instruction set, Instruction timings. Subroutines, Timing diagrams and Execution Cycles. (8 Hours)

UNIT-4
8051 Programming: Assembly language programs, C language programs, Assemblers and compilers, Programming and debugging tools.
Memory and I/O Interfacing: Memory and I/O expansion buses, Control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, Analog to Digital Converter (ADC), Digital to Analog converter (DAC), timers, counters, and memory devices. (10 Hours)

UNIT-5
External Communication Interface: Synchronous and Asynchronous Communication, RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. Applications of LED, LCD and keyboard interfacing, interfacing of Stepper motor, DC Motor, and sensors. (8 Hours)

Text / References Books:
Ramesh S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishers, 1996.
Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education, 2007.
Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International Publishing/ Thomson Publishers, 2nd Edition, 2005.
D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
D. V. Hall, "Microprocessors and Interfacing", McGraw Hill Higher Education, 1991.

Course Outcomes: At the end of this course, students will demonstrate the ability to
Do assembly language programming.
Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
Develop systems using different microcontrollers.

OEC-EC02 Microprocessors and	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2

Interfacing														
CO1	3	2	3	2	3		1			1	1	3		
CO2	2	3	2	3	2	1						2		
CO3	2	2	1	1	3	2					1	2		

OEC-EC04	Data and Computer Communication	3L:0T:0P	3 credits

Pre-Requisites: Data Structure, Computer Architecture and Organization

UNIT-1

Data communications: Introduction – History of data communications – Data communications circuits – Data communications codes – Error control – Synchronization – Data communications hardware – serial interfaces – Transmission media and data modems.

UNIT-1

Data communications protocols: Introduction- public data network – ISO protocol hierarchy – CCITT X.25 user to network interface protocol – Local area networks – Metropolitan area networks – Wide area networks.

UNIT-1

Digital multiplexing: Time-division multiplexing – TI digital carrier system – CCITT time –division – Multiplexed carrier system – codecs – T-carriers-frame synchronization – Bit interleaving versus word interleaving. Frequency division multiplexing: AT & T's FDM hierarchy – composite baseband signal – L carriers – Hybrid data.

UNIT-1

Multiple access: TDMA – FDMA – CDMA – CSMA/CD – multiple access information flow – Demand – assignment multiple access – access algorithms – ALOHA, slotted ALOHA, polling techniques.

UNIT-1

Spread-spectrum techniques: The beneficial attributes of spread-spectrum systems model for spread-spectrum interference rejection – Pseudonoise sequences.

Direct-sequence spread-spectrum systems – examples of direct sequencing – processing gain and performance

Text / References Books:

Wayne Tomasi, 'Advanced Electronic Communications Systems', Pearson Education [I,II and III].

Bernard Sklar, Digital Communications – Fundamentals and Aapplications, 2nd Eedition, Pearson Education [IV and V]

Stallings – Data and Computer Commnication, 6th Edition, Pearson Education.

Taub & Schlling, Principles of Communication System, Mc Graw Hill.

Course Outcomes: After completion of course, students would be able to:

OEC-EC02 Microprocessors and Interfacing	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		

OEC-EC06	**Big Data Analytics**	**3L:0T:0P**	**3 credits**

Pre-Requisites: Data Structure, Computer Architecture and Organization

COURSE OBJECTIVES:
Understand big data for business intelligence. Learn business case studies for big data analytics.
Understand nosql big data management.
Perform map-reduce analytics using Hadoop and related tools

UNIT-1
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. (8 Hours)

UNIT-2
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.
(8 Hours)

UNIT-3
Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures. (9 Hours)

UNIT-4

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. (10 Hours)

UNIT-5

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. (12 Hours)

Text / References Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley

Course Outcomes: After completion of course, students would be able to:

Describe big data and use cases from selected business domains.
Explain NoSQL big data management, Install, configure, and run Hadoop and HDFS.
Perform map-reduce analytics using Hadoop.
Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

OEC-EC06 Big Data Analytics	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		
CO2	**2**	**3**	**2**	**3**	**2**	**1**						**2**		
CO3	**2**	**2**	**1**	**1**	**3**	**2**					**1**	**2**		
CO4	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		

	Remote Sensing	3L:0T:0P	3 credits
Course Outcomes: At the end of this course, students shall be able to Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles. Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.			
Contents: **Unit 1** Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.			

Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned space crafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRDetc.

Unit 2

Photographic products, B/W,color, color IR film and their characteristics –resolving power of lens and film - Optomechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.

Unit 3

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 4

Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

Unit 5

Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping.

Text / References Books:

Lillesand.T.M. and Kiefer.R.W,"Remote Sensing and Image interpretation", 6thEdition, John Wiley & Sons, 2000.

John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, Prentice Hall,1995.

Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis",5th Edition, Springer-Verlag Berlin Heidelberg, 2013.

Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.

Charles Elachi, Jakob J. van Zyl, "Introduction to The Physicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.

Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W.H.Freeman& Co, 1978.

Remote Sensing	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**2**	**3**	**2**	**3**	**2**	**1**						**2**		
CO2	**2**	**2**	**1**	**1**	**3**	**2**					**1**	**2**		
CO3	**3**	**2**	**3**	**2**	**3**		**1**			**1**	**1**	**3**		