K.S.INSTITUTE OF TECHNOLOGY, BANGALORE

(AFFLIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

ENGINEERING MATHEMATICS-IV

(Common to all Branches)

Course Title: Engineering Mathematics-IV **Course Code : 15MAT41**

Credits:04 **L-T-P :4-0-0**

Contact Hours/Week: 04 **Total Hours:50**

Exam. Marks:60 **IA Marks :40**

Exam. Hours : 03

Module-1
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor‘s series method, modified Euler‘s method, Runge - Kutta method of fourth order. Milne‘s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). **L1, L3**
Module-2
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne‘s method. **Special Functions:** Series solution-Frobenious method. Series solution of Bessel‘s differential equation leading to $J_n(x)$-Bessel‘s function of first kind. Basic properties andorthogonality.SeriessolutionofLegendre‘sdifferentialequationleadingto$P_n(x)$-Legendre polynomials. Rodrigue‘s formula, problems.**L3**
Module-3
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability.Analyticfunctions-Cauchy-Riemannequationsincartesianandpolar forms. Properties and construction of analytic functions. Complex line integrals- Cauchy‘s theorem and Cauchy‘s integral formula, Residue, poles, Cauchy‘s Residue theorem (without proof) and problems. **L1,L3** **Transformations:** Conformal transformations, discussion of transformations: $w z^2$, $w e^z$, $w z\ 1\ z\ z0$ and bilinear transformations-problems. **L1**
Module-4

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions,problems.

Jointprobabilitydistribution: JointProbabilitydistributionfortwodiscreterandom variables, expectation, covariance, correlation coefficient.**L3**

Module-5

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t- distribution,Chi-squaredistributionasatestof goodness of fit.**L3**

Stochasticprocess: Stochasticprocesses,probabilityvector,stochasticmatrices,fixed points, regular stochastic matrices, Markov chains, higher transition probability- simple problems.**L1**

Course Outcomes: On completion of this course, students are able to:

- Solvefirstandsecondorderordinarydifferentialequationsarisinginflow problemsusingsinglestepandmultistepnumericalmethods.
- Understandtheanalyticity,potentialfields,residuesandpolesofcomplex potentials in field theory and electromagnetictheory.
- Describeconformalandbilineartransformationarisinginaerofoiltheory,fluid flow visualization and imageprocessing.
- Solveproblemsofquantummechanics,hydrodynamicsandheatconductionby employingBessel'sfunctionrelatingtocylindricalpolarcoordinatesystemsand Legendre'spolynomialsrelatingtosphericalpolarcoordinatesystems.
- Solveproblemsonprobabilitydistributionsrelatingtodigitalsignalprocessing, information theory and optimization concepts of stability of design and structuralengineering.
- Drawthevalidityofthehypothesisproposedforthegivensamplingdistribution in accepting or rejecting thehypothesis.
- Determinejointprobabilitydistributionsandstochasticmatrixconnectedwith themultivariablecorrelationproblemsforfeasiblerandomevents.
- Define transition probability matrix of a Markov chain and solve problems related to discrete parameter randomprocess.

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, KhannaPublishers,43rd Ed., 2015.
2. E.Kreyszig:AdvancedEngineeringMathematics,JohnWiley&Sons,10thEd., 2015.

Reference Books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers,7thEd.,2010.
2. B.V.Ramana:"HigherEngineeringMathematics"TataMcGraw-Hill,2006.
3. H. K. Dass and Er. RajnishVerma: "Higher EngineeringMathematics", S. Chand publishing, 1stedition,2011.

Web Link and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.khanacademy.org/
3. http://www.class-central.com/subject/math

ADDITIONAL MATHEMATICS - II

B.E., IV Semester, Common to all Branches

(A Bridge course for Lateral Entry students of IV Sem. B. E.) [As per Choice Based Credit System (CBCS) Scheme]

Course Code	**15MATDIP41**	**CIE Marks**	**--**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hours per Module)**	**Exam Hours**	**03**

Credits – 00

Course Objectives: This course will enable students to:

- Understand essential concepts of linear algebra. Solve second
- and higher order differential equations.
- UnderstandLaplaceandinverseLaplacetransformsandelementaryprobability theory.

Module-1

LinearAlgebra: Introduction-rankofmatrixbyelementaryrowoperations-Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen valuesandEigenvectorsofasquarematrix.ApplicationofCayley-Hamiltontheorem (without proof) to compute the inverse of a matrix-Examples.**L1,L3**

Module-2

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of
undetermined coefficients and variation of parameters. **L1,L3**

Module-3

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals**,** transforms of periodic function and unit step function- Problems only. **L1,L2**

Module-4

Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inversetransformsbystandardmethods.ApplicationtosolutionsofLineardifferential equations and simultaneous differential equations.**L1,L2**

Module-5

Probability: Introduction.Samplespaceandevents.Axiomsofprobability.Addition andmultiplicationtheorems.Conditionalprobability–illustrativeexamples.Bayes's theorem-examples.**L1,L2**

Course Outcomes: On completion of this course, students are able to:

- Solvesystemsoflinearequationsinthedifferentareasoflinearalgebra.
- Solvesecondandhigherorderdifferentialequationsoccurringinofelectrical circuits, damped/un-dampedvibrations.
- DescribeLaplacetransformsofstandardandperiodicfunctions.
- DeterminethegeneralcompletesolutionstolinearODEusinginverseLaplace transforms.
- Recallbasicconceptsofelementaryprobabilitytheoryand,solveproblemsrelated

to the decision theory, synthesis and optimization of digital circuits.

Text Book:

B.S.Grewal:HigherEngineeringMathematics,KhannaPublishers,43rdEd.,2015.

Reference Books:

1. E.Kreyszig:AdvancedEngineeringMathematics,JohnWiley&Sons,10thEd., 2015.
2. N.P.BaliandManishGoyal:ATextBookofEngineeringMathematics,Laxmi Publishers, 7thEd.,2007.

SIGNALS ANDSYSTEMS

SEMESTER – IV(EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC42**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to:

- Understandthemathematicaldescriptionofcontinuousanddiscretetimesignals andsystems.
- Analyzethesignalsintimedomainusingconvolutiondifference/differential equations
  Classify signals into different categories based on their properties.
  AnalyzeLinearTimeInvariant(LTI)systemsintimeandtransformdomains.
- Buildbasicsforunderstandingofcoursessuchassignalprocessing,control system
- andcommunication.
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Module -1

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodicandnon-periodic,deterministicandnon-deterministic,energyandpower.

Elementarysignals/Functions: Exponential,sine,impulse,stepanditsproperties, ramp, rectangular, triangular, signum, syncfunctions.

Operationsonsignals: Amplitudescaling,addition,multiplication,differentiation, integration(AccumulatorforDT),timescaling,timeshiftingandtimefolding.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. **L1, L2, L3**

Module -2

Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computationofconvolutionintegralandconvolutionsumusinggraphicalmethodfor unitsteptounitstep,unitsteptoexponential,exponentialtoexponential,unitstep torectangularandrectangulartorectangularonly.Propertiesofconvolution.

L1, L2, L3

Module -3

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours).

Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition,properties(Noderivation)andbasicproblems(inverseFourierseriesis excluded) (06 Hours). **L1, L2,L3**

Module -4

Fourier Representation of aperiodic Signals:
FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours).
FTrepresentationofaperiodicdiscretesignals-DTFT,definition,DTFTofstandard discretesignals,Propertiesandtheirsignificance (4Hours).
Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours). **L1, L2, L3**

Module -5

Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence,PropertiesoftheZ-Transform,InversionoftheZ-Transform,Transform analysis of LTI systems. **L1, L2,L3**

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

- Identify different types of signals (continuous/discrete, periodic/aperiodic, even /odd, energy/power and deterministic/random signals.)
- Identify the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
- Solve the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.
- Solve the spectral characteristics of continuous and discrete time signal using Fourier analysis.
- Solve Z-transforms, inverse Z-transforms and transfer functions of complex LTI systems.

Text Book:
SimonHaykinsandBarryVanVeen,—SignalsandSystems‖,2ndEdition, 2008, WileyIndia. ISBN9971-51-239-4.

Reference Books:

1. **Michael Roberts,** -FundamentalsofSignals&Systems‖,2ndedition, Tata McGraw-Hill, 2010, ISBN978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab,—**Signals and Systems‖ Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint2002.
3. **H. P Hsu, R. Ranjan, —**Signals and Systems‖, Scham's outlines, TMH, 2006.
4. **B.P.Lathi,—**LinearSystemsandSignals‖,OxfordUniversityPress,2005.
5. **GaneshRaoandSatishTunga,—**SignalsandSystems‖,Pearson/Sanguine Technical Publishers,2004.

Web Link and Video Lectures:
1. https://www.classcentral.com/course/swayam-principles-of-signals-and-systems
2. https://freevideolectures.com/subject/signals-systems/

CONTROL SYSTEMS

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC43**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to:

- Understandthebasicfeatures,configurationsandapplicationofcontrolsystems.
- Understandvarioustermino logiesanddefinitionsforthecontrolsystems.
- Learnhowtofindamathematicalmodelofelectrical,mechanicalandelectro- mechanicalsystems. Knowhowtofindtimeresponsefromthetransferfunction. Find the transfer
- function via Masons'rule.
- Analyze the stability of a system from the transfer function.
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Module -1

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems,DifferentialequationofPhysicalSystems–MechanicalSystems,Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions,BlockdiagramalgebraandSignalFlowgraphs.**L1,L2,L3**

Module -2

TimeResponseoffeedbackcontrolsystems:Standardtestsignals,Unitstepresponse of First and Second order Systems. Time response specifications, Time response specificationsofsecondordersystems,steadystateerrorsanderrorconstants.
Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

Module -3

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stabilitycriterion,Relativestabilityanalysis:moreontheRouthstabilitycriterion, IntroductiontoRoot-LocusTechniques,Therootlocusconcepts,Constructionofroot loci. **L1, L2,L3**

Module -4

Frequency domain analysis and stability:
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.
Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)
Introduction to lead, lag and lead-lag compensating networks (excluding design).
L1, L2, L3

Module -5

Introduction to Digital Control System: Introduction, Spectrum Analysis of Samplingprocess,Signalreconstruction,Differenceequations. IntroductiontoState variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation.

L1, L2, L3

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

- Develop the mathematical model of mechanical / electrical systems and obtain its transfer function using block reduction method /Signal flow graph method
- Ability to relate transient performance parameters (overshoot, rise time, peak time and settling time) for the given system and to evaluate steady state error.
- Identify various stability criteria and determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
- Determine the stability of a system in the frequency domain using Nyquist and bode plots
- Develop a control system model in continuous and discrete time using state variable techniques

TextBook:

J.Nagarath and M.Gopal, ― Control Systems Engineering‖, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.

Reference Books:

1. ―ModernControlEngineering,‖K.Ogata,PearsonEducationAsia/PHI,4th Edition, 2002. ISBN978-81-203-4010-7.
2. ―AutomaticControlSystems‖,BenjaminC.Kuo,JohnWileyIndiaPvt.Ltd.,8th Edition,2008.
3. ―FeedbackandControlSystem,‖JosephJDistefanoIIIetal.,Schaum's Outlines, TMH, 2nd Edition2007.

Web Link and Video Lectures:

1. https://www.udemy.com/topic/control-systems/
2. https://www.coursera.org/courses?query=control%20systems

PRINCIPLES OF COMMUNICATION SYSTEMS
SEMESTER – IV (EC/TC)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC44**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to:

- Designsimplesystemsforgeneratinganddemodulating AM, DSB, SSB and VSB signals.
- UnderstandtheconceptsinAnglemodulationforthedesignofcommunication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
  Learn the concepts of random process and various types of noise.
  Evaluatetheperformanceofthecommunicationsysteminpresenceofnoise. Analyze pulse modulation and samplingtechniques.
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Module – 1

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency–Domaindescription,Ringmodulator,Coherentdetection,CostasReceiver,Quadrature CarrierMultiplexing.

SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODSOFMODULATION: SSB Modulation,VSBModulation,FrequencyTranslation,Frequency-DivisionMultiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text). **L1, L2,L3**

Module – 2

ANGLEMODULATION:Basicdefinitions,FrequencyModulation:NarrowBandFM,Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text). **L1, L2,L3**

Module – 3

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Randomvariables,SeveralRandomVariables.StatisticalAverages:Functionofarandom variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions (refer Chapter 5 of Text).

NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text). **L1, L2, L3**

Module – 4

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers,NoiseinAMreceivers,Thresholdeffect,NoiseinFMreceivers,Captureeffect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text). **L1, L2,L3**

Module – 5

DIGITALREPRESENTATIONOFANALOGSIGNALS: Introduction,WhyDigitizeAnalog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing,Pulse-PositionModulation,GenerationofPPMWaves,DetectionofPPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1). **L1, L2,L3**

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

- Apply the time and frequency domain knowledge for the generation and demodulation of amplitude modulated signals.
- Identify the performance of different generation and detection methodologies of AM, FM and multiplexing.
- Utilize analog signals in time domain as random processes and identify the types of basic Noise
- Identify the influence of noise in receivers of analog modulated signals
- Compare the characteristics of pulse modulation techniques.

Text Book:

Communication Systems, Simon Haykins&Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books:

1. **ModernDigitalandAnalogCommunicationSystems,**B.P.Lathi,Oxford University Press., 4thedition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN978–81–265–3653–5.
3. **PrinciplesofCommunicationSystems**,H.Taub&D.L.Schilling,TMH, 2011.
4. **CommunicationSystems**,HaroldP.E,SternSamyandA.Mahmond,Pearson Edition,2004.
5. **CommunicationSystems**:**AnalogandDigital,**R.P.SinghandS.Sapre:TMH2nd edition, 2007.

Web Link and Video Lectures:

1. https://swayam.gov.in/nd1_noc19_ee46/preview
2. https://www.udemy.com/course/analog-communication/

LINEAR INTEGRATED CIRCUITS

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC45**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to:

- Defineanddescribevariousparametersof Op-Amp,itscharacteristicsand specifications.
- DiscusstheeffectsofInputandOutputvoltagerangesuponOp-Ampcircuits. SketchandAnalyzeOp-Ampcircuitstodetermine InputImpedances,output Impedances and other performanceparameters.
- SketchandExplaintypicalFrequencyResponsegraphsforeachoftheFiltercircuits showing Butterworth and Chebyshev responses where ever appropriate.
- DescribeandSketchthevariousswitchingcircuitsofOp-Ampsandanalyzeits operations.
- DifferentiatebetweenvarioustypesofDACsandADCsandevaluatetheperformance ofeachwithneatcircuitdiagramsandassumingsuitableinputs.

Module – 1

Operational Amplifier Fundamentals:

Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequencylimitations.**OP-AmpsasDCAmplifiers**–BiasingOP-amps,Directcoupled voltagefollowers,Non-invertingamplifiers,invertingamplifiers,Summingamplifiers, andDifferenceamplifiers.InterpretationofOP-ampLM741&TL081datasheet.**(Text1) L1,L2,L3**

Module – 2

Op-AmpsasACAmplifiers: Capacitorcoupledvoltagefollower,Highinputimpedance –Capacitorcoupledvoltagefollower,Capacitorcouplednoninvertingamplifiers,High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled invertingamplifiers,settingtheuppercut-offfrequency,Capacitorcoupleddifference amplifier.

OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.**(Text1) L1, L2,L3**

Module – 3

MoreApplications: Limitingcircuits,Clampingcircuits,Peakdetectors,Sampleand hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors**,** inverting Schmitt trigger. **(Text1)**

Log and antilog amplifiers, Multiplier and divider. **(Text2) L1, L2,L3**

Module – 4

ActiveFilters: FirstorderandsecondorderactiveLow-passandhighpassfilters, Bandpass Filter, Bandstop Filter. **(Text1)**

VoltageRegulators: Introduction,SeriesOp-ampregulator,ICvoltageregulators.723 general purpose regulators.**(Text2)** **L1,L2,L3**

Module – 5

Phase locked loop: Basic Principles, Phase detector/comparator, VCO.
DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation.

Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostablemultivibrator. **(Text 2) L1, L2,L3**

Course Outcomes: After studying this course, students will be able to:

- Identify Op-amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate.
- Construct Op-amp based AC Amplifiers and Develop circuits for Op-amp based Voltage / Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers.
- Develop circuits for Op Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator / Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider.
- Design first & Second Order Filters and Voltage Regulators.
- Illustrate applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

TextBooks:

1. -OperationalAmplifiersandLinearIC‘s‖,DavidA.Bell,2ndedition,PHI/Pearson, 2004. ISBN978-81-203-2359-9.
2. ―Linear IntegratedCircuits‖, D. Roy Choudhury and Shail B. Jain, 4thedition,Reprint2006,NewAgeInternationalISBN978-81-224-3098-1.

Reference Books:

1. Ramakant A Gayakwad, ―Op-Amps and Linear Integrated Circuits‖, Pearson, 4th Ed, 2015. ISBN81-7808-501-1.
2. BSomanathanNair,―LinearIntegratedCircuits:Analysis,Design&Applications,‖ Wiley India, 1st Edition,2015.
3. JamesCox,―LinearElectronicsCircuitsandDevices‖,CengageLearning, Indian Edition, 2008, ISBN-13:978-07-668-3018-7.
4. Data Sheet:http://www.ti.com/lit/ds/symlink/tl081.pdf.

Web Link and Video Lectures:

1. https://e-box.co.in/linear-integrated-circuits.shtml
2. https://freevideolectures.com/course/2915/linear-integrated-circuits

MICROPROCESSORS

SEMESTER – IV(EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC46**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to: Familiarize basic

- architecture of 8086 microprocessor Program 8086 Microprocessor using
- Assembly Level Language Use Procedures in 8086 Programs
- Understandinterfacingof16bitmicroprocessorwithmemoryandperipheralchips involving systemdesign
- UnderstandtheVon-Neumann,Harvard,CISC&RISCCPUarchitecture.

Module -1

8086PROCESSOR: Historicalbackground(referReferenceBook1),8086CPU Architecture (1.1 – 1.3 ofText).

Addressing modes, Machine language instruction formats. (2.2, 2.1 of Text).

INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text). **L1, L2, L3**

Module -2

Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs.AssemblerDirectivesandOperators,AssemblyLanguageProgramming and example programs (2.3, 2.4, 3.4 of Text). **L1, L2,L3**

Module -3

Stack and Interrupts:

Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Timing and Delays. (Chap. 4 of Text). **L1, L2, L3**

Module -4

8086 Bus Configuration and Timings:

Physical memory Organization, General Bus operation cycle, I/O addressing capability,Specialprocessoractivities,Minimummode8086systemandTiming diagrams,MaximumMode8086systemandTimingdiagrams.(1.4to1.9ofText).

Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacingwith8086(5.1.1),InterfacingI/Oports,PIO8255,Modesofoperation– Mode-0 and BSR Mode, Interfacing simple switches and simple LEDs using 8255 (Refer 5.3, 5.4, 5.5 of Text). **L1, L2,L3**

Module 5

Basic Peripherals and their Interfacing with 8086 (Part 2):
Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1,5.7.2,5.8).Timer8254–Mode0&3andInterfacingprogrammesforthese modes (refer 6.1 ofText).

INT21HDOSFunctioncalls-forhandlingKeyboardandDisplay(referAppendix-B ofText).

Von-Neumann&HarvardCPUarchitectureandCISC&RISCCPUarchitecture(refer Reference Book 1).
L1, L2,L3

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

- Identify the different CPU architectures, 8086 Microprocessor architecture and addressing modes of 8086.
- Make use of the instruction set and addressing modes of 8086 to develop assembly language programs
- Make use of stacks , interrupts to develop programs
- Model the static memory chips, 8255 & 8254, and use of INT 21 DOS interrupt function calls to handle keyboard and display
- Experiment with 8086 Microprocessor the ADC-0808, DAC-0800 and stepper motors using PPI 8255 with 8086.

TextBook:

Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rdEdition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. **MicroprocessorandInterfacing**-DouglasVHall,SSSPRao,3rdedition TMH,2012.
2. **Microcomputer systems-The 8086 / 8088 Family**–Y.C. Liu andA. Gibson, 2ndedition, PHI-2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** – KennethJAyala,CENGAGELearning,2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing**-BarryB.Brey,6e,PearsonEducation/PHI,2003.

Web Link and Video Lectures:

1. https://www.coursera.org/courses?query=microprocessor
2. https://www.udemy.com/course/certificate-program-in-introduction-to-microprocessors/

MICROPROCESSOR LAB

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	**17ECL47**	**CIE Marks**	**40**
Number ofLecture Hours/Week	**01Hr Tutorial (Instructions) + 02 Hours Laboratory**	**SEE Marks**	**60**
RBT Level	**L1, L2, L3**	**Exam Hours**	**03**

CREDITS – 02

Course objectives: This course will enable students to:

- GetfamiliarizewithinstructionsandDOS21Hinterruptsandfunctioncalls.
- Developandtestassemblylanguageprogramstouseinstructionsof8086.
- Getfamiliarizewithinterfacingofvariousperipheraldeviceswith8086 microprocessor for simpleapplications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:

i) Byte and word datatransfer in different addressing Modes
ii) Block move (with and withoutoverlap)
iii) Blockinterchange

2. Programs involving:

Arithmetic & logical operations like:

i) Addition and Subtraction of multi precisionnos.
ii) MultiplicationandDivisionofsignedandunsignedHexadecimalnos.
iii) ASCII adjustmentinstructions.
iv) Codeconversions.

3. Programs involving:

Bit manipulation instructions like checking:

i) Whether given data is positive ornegative
ii) Whether given data is odd oreven
iii) Logical 1‘s and 0‘s in a givendata
iv) 2 out 5code
v) Bit wise and nibble wisepalindrome

4. Programs involving:

Branch/ Loop instructions like

i) Arrays:addition/subtractionofNnos.,Findinglargestandsmallestnos.,Ascending and descendingorder.
ii) TwoapplicationprogramsusingProceduresandMacros(Subroutines).

5. Programs involving

String manipulation like string transfer, string reversing, searching for a string.

6. Programs involving

ProgramstouseDOSinterruptINT21hFunctioncallsforReadingaCharacterfrom keyboard,BufferedKeyboardinput,Displayofcharacter/Stringonconsole.

7. Interfacing Experiments:

Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card /8086 Trainer)

1. Matrix keyboardinterfacing
2. Seven segment displayinterface
3. Logical controllerinterface
4. Stepper motorinterface
5. ADC and DAC Interface (8bit)
6. Lightdependentresistor(LDR),Relayand Buzzer Interface to make lightoperated switches

CourseOutcomes: Onthecompletionofthislaboratorycourse,thestudentswillbeable to:

- Identify the different CPU architectures, 8086 Microprocessor architecture and addressing modes of 8086.
- Make use of the instruction set and addressing modes of 8086 to develop assembly language programs
- Make use of stacks , interrupts to develop programs.
- Model the static memory chips, 8255 & 8254, and use of INT 21 DOS interrupt function calls to handle keyboard and display
- Experiment with 8086 Microprocessor to interface the ADC-0808, DAC-0800 and stepper motor using PPI 8255.

Conduct of Practical Examination:

All laboratory experiments are to be included for practical examination.
Forexamination,onequestionfromsoftwareandonequestionfromhardware interfacing to beset.
Students are allowed to pick one experiment from the lot.
ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.

LINEAR ICS AND COMMUNICATION LAB

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	**17ECL48**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**01Hr Tutorial (Instructions) + 02 Hours Laboratory**	**SEE Marks**	**60**
RBT Level	**L1, L2, L3**	**Exam Hours**	**03**

CREDITS – 02

Courseobjectives: This laboratory course enables studentsto:

- Design,DemonstrateandAnalyzeinstrumentationamplifier,filters,DAC,adder, differentiator and integrator circuits, usingop-amp.
- Design,DemonstrateandAnalyzemultivibratorsandoscillatorcircuitsusing Op-amp
- Design,DemonstrateandAnalyzeanalogsystemsforAM,FMandMixer operations.
  Design,DemonstrateandAnalyzebalancemodulationandfrequencysynthesis.
  DemonstrateandAnalyzepulsesamplingandflattopsampling.
-
-

Laboratory Experiments:

1. Designaninstrumentationamplifierofadifferentialmodegainof_A'usingthree amplifiers.
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.
3. Design active second order Butterworth low pass and high pass filters.
4. Design4bitR–2ROp-AmpDigitaltoAnalogConverter(i)using4bitbinaryinput fromtoggleswitchesand(ii)bygeneratingdigitalinputsusingmod-16counter.
5. Design Adder, Integrator and Differentiator using Op-Amp.
6. Design of Monostable and AstableMultivibrator using 555 Timer.
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.
8. Amplitude modulation using transistor/FET (Generation and detection).
9. Frequency modulation using IC 8038/2206 and demodulation.
10. Design BJT/FET Mixer.
11. DSBSC generation using Balance Modulator IC 1496/1596.
12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Inspect the basic analog systems for a given specification using the basic building blocks and ICs.
- Examine the performance of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- Alllaboratoryexperimentsaretobeincludedforpracticalexamination.
- Studentsareallowedtopickoneexperimentfromthelot.

ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.

B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC61**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours/Module)**	**Exam Hours**	**03**

CREDITS – 04

Course Objectives: The objectives of the course is to enable students to:

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functionalblocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channelconditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channelconditions.

Module-1

Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complexenvelopes,Canonicalrepresentationofbandpasssignals,Complexlowpass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12,2.13).

Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).

Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2) **L1, L2, L3**

Module-2

SignalingoverAWGNChannels-Introduction,Geometricrepresentationofsignals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding,Correlationreceiver,matchedfilterreceiver(Text1:7.1,7.2,7.3,7.4).
L1, L2, L3

Module-3

Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM (Relevant topics in Text 1 of 7.6, 7.7).

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 1 of 7.8).

Noncoherentorthogonalmodulationtechniques:BFSK,DPSKSymbolrepresentation, BlockdiagramstreatmentofTransmitterandReceiver,Probabilityoferror(without

derivation of probability of error equation) (Text 1: 7.11, 7.12. 7.13). **L1, L2, L3**

Module-4

Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, SignaldesignforBandlimitedChannels:DesignofbandlimitedsignalsforzeroISI–TheNyquistCriterion(statementonly),Designofbandlimitedsignalswithcontrolled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detectionofdatawithcontrolledISI(Text2:9.1,9.2,9.3.1,9.3.2).

Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2). **L1, L2, L3**

Module-5

Principles of Spread Spectrum: Spread Spectrum Communication Systems:Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread SpectrumSystems,EffectofDe-spreadingonanarrowbandInterference,Probability of error (statement only), Some applications of DS Spread Spectrum Signals, GenerationofPNSequences,FrequencyHoppedSpreadSpectrum,CDMAbasedon IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2). **L1, L2, L3**

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

- Develop the concepts of Band pass sampling to well specified signals and channels.
- Utilize the performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.
- Identify valid symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.
- Identify the bandpass signals when subjected to corruption and distortion during transmission over a bandlimited channel.
- Identify the need for data security using spread spectrum technique and error rate calculation.

TextBooks:

1. Simon Haykin, ―Digital Communication Systems‖, John Wiley & sons, First Edition, 2014, ISBN978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, ―Fundamentals of Communication Systems‖,2014Edition,PearsonEducation,ISBN978-8-131-70573-5.

Reference Books:

1. B.P.Lathi and Zhi Ding, ―Modern Digital and Analog communication Systems‖, OxfordUniversityPress,4th Edition,2010,ISBN:978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, ―Digital Communications‖, PearsonEducation, Third Edition, 2010, ISBN978-0-273-71830-7.
3. JohnGProakisandMasoudSalehi,―CommunicationSystemsEngineering‖,2nd Edition, Pearson Education, ISBN978-93-325-5513-6.

Web Link and Video Lectures:

1. https://www.classcentral.com/course/swayam-modern-digital-communication-techniques
2. https://nptel.ac.in/courses/117/101/117101051/

ARM MICROCONTROLLER & EMBEDDED SYSTEMS

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC62**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to:

- Understandthearchitecturalfeaturesandinstructionsetof32bit microcontroller ARM CortexM3.
- ProgramARMCortexM3usingthevariousinstructionsandClanguagefor differentapplications.
- Understandthebasichardwarecomponentsandtheirselectionmethodbasedon the characteristics and attributes of an embeddedsystem.
  Develop the hardware software co-design and firmware design approaches.
- Explaintheneedofrealtimeoperatingsystemforembeddedsystemapplications.
-

Module-1

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, ArchitectureofARMCortexM3,VariousUnitsinthearchitecture,Debuggingsupport, GeneralPurposeRegisters,SpecialRegisters,exceptions,interrupts,stackoperation, reset sequence (Text 1: Ch 1, 2, 3) **L1, L2**

Module-2

ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) **L1, L2, L3**

Module-3

Embedded System Components: Embedded Vs General computing system, ClassificationofEmbeddedsystems,MajorapplicationsandpurposeofES.Coreof anEmbeddedSystemincludingalltypesofprocessor/controller,Memory,Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other systemcomponents. (Text2:AlltheTopicsfromCh-1andCh-2,excluding2.3.3.4(steppermotor),2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). **L1, L2, L3**

Module-4

Embedded System Design Concepts: Characteristics and Quality Attributes of EmbeddedSystems,Operationalandnon-operationalqualityattributes,Embedded Systems-Application and Domain specific, Hardware Software Co-Design and ProgramModelling(excludingUML),Embeddedfirmwaredesignanddevelopment (excluding Clanguage). (Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5
RTOS and IDE for Embedded System Design: Operating System basics, Types of operatingsystems,Task,processandthreads(OnlyPOSIXThreadswithanexample program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excludingKeil), Disassembler/decompiler, simulator, emulator and debugging techniques (Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only) **L1, L2, L3**
Course outcomes: After studying this course, students will be able to: • Construct the architectural features and instructions of 32 bit microcontroller ARM Cortex M3. • Make use of the knowledge gained for Programming ARM Cortex M3 for different applications. • Identify the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. • Develop the hardware/software co-design and firmware design using ARM Cortex M3.Instruction set. • Analyze the need of real time operating system for embedded system applications
TextBooks: 1. JosephYiu,―TheDefinitiveGuidetotheARMCortex-M3‖,2nd Edition,Newnes, (Elsevier),2010. 2. ShibuKV,―IntroductiontoEmbeddedSystems‖,TataMcGrawHillEducation Private Limited, 2nd Edition.

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/117/106/117106111/
2. https://www.classcentral.com/course/swayam-embedded-system-design-with-arm

VLSI DESIGN

B.E., VI Semester, Electronics & Communication Engineering [As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC63**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours / Module)**	**Exam Hours**	**03**
CREDITS – 04			

Course Objectives: The objectives of the course is to enable students to:

ImpartknowledgeofMOStransistortheoryandCMOStechnologies Impart knowledge on architectural choices and performance tradeoffs
involvedindesigningandrealizingthecircuitsinCMOStechnology Cultivate the concepts of subsystem designprocesses
Demonstrate the concepts of CMOS testing

Module-1

Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics
(1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).
Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8,1.10 of TEXT1). **L1, L2**

Module-2

MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.
Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).
L1, L2, L3

Module-3

Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters **Subsystem Design Processes:** Some General considerations, An illustration of Design Processes, **Illustration of the Design Processes**- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1). **L1, L2, L3**

Module-4

Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA)
(6.1to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).
FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGAbasedSystemdesign,FPGAarchitecture,PhysicaldesignforFPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3). **L1, L2,L3**

Module-5

Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).
Testing and Verification: Introduction, Logic Verification, Logic Verification Principles,ManufacturingTestPrinciples,Designfortestability(12.1,12.1.1,12.3, 12.5, 12.6 of TEXT 2). **L1, L2, L3**

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

- Utilize the concept of basic MOS transistor, CMOS fabrication flow and technology scaling.
- Make use of the knowledge of physical design aspects to make stick and layout diagrams for various gates.
- Identify the concept of Memory elements along with timing considerations with scaling fundamentals
- Experiment with the basic knowledge of FPGA based system design and testability issues in VLSI Design
- Analyze the various CMOS subsystems and architectural issues with the design constraints.

TextBooks:

1. **"Basic VLSI Design"**- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition –1994).
2. **"CMOS VLSI Design- A Circuits and Systems Perspective"-** Neil H.E. Weste, DavidHarris,AyanBanerjee,3rdEdition,PearsonEducation.
3. **"FPGABasedSystemDesign"-**WayneWolf,PearsonEducation,2004, Technology andEngineering.

Web Link and Video Lectures:

1. https://www.coursera.org/learn/vlsi-cad-logic
2. https://www.classcentral.com/tag/vlsi-design

COMPUTER COMMUNICATION NETWORKS

B.E., VI Semester, Electronics & Communication Engineering / Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC64**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of LectureHours	**50 (10 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 04

Course Objectives: This course will enable students to:

- UnderstandthelayeringarchitectureofOSIreferencemodelandTCP/IPprotocol suite.
- Understand the protocols associated with eachlayer.
- Learn the different networking architectures andtheirrepresentations.

Learnthevariousroutingtechniquesandthetransportlayerservices.

Module-1

Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet.
Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.
Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers,LinkLayeraddressing:Typesofaddresses,ARP.DataLinkControl(DLC) services:Framing,FlowandErrorControl,DataLinkLayerProtocols:SimpleProtocol, Stop and Wait protocol, Piggybacking. **L1, L2**

Module-2

Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing.
Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. **L1, L2**

Module-3

WirelessLANs: Introduction:ArchitecturalComparison,Characteristics,IEEE802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture,Layers.
Connecting Devices: Hubs, Switches, **Virtual LANs:** Membership, Configuration, Communication between Switches and Routers, Advantages.
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach,IPV4Addresses:AddressSpace,ClassfulAddressing,ClasslessAddressing, DHCP,NetworkAddressResolution,ForwardingofIPPackets:Basedondestination Address and Label. **L1, L2**

Module-4

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation,

Options,SecurityofIPv4Datagrams,ICMPv4:Messages,DebuggingTools,MobileIP: Addressing,Agents,ThreePhases,InefficiencyinMobileIP.

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol

Version 4. **L1, L2, L3**

Module-5

Transport Layer: Introduction: Transport Layer Services, Connectionless and ConnectionorientedProtocols,TransportLayerProtocols:Simpleprotocol,Stopand waitprotocol,Go-Back-NProtocol,Selectiverepeatprotocol,UserDatagramProtocol: UserDatagram,UDPServices,UDPApplications,TransmissionControlProtocol:TCP Services,TCPFeatures,Segment,Connection,StateTransitiondiagram,Windowsin TCP, Flow control, Error control, TCP congestion control. **L1,L2**

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

- Make use of the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
- Identify the protocols and services of Data link layer and Media access control.
- Distinguish wired and wireless LANS architectures, protocols and the associated connecting devices.
- Analyse the packetizing, routing and forwarding services and associated protocols of Network layer.
- Analyse the protocols and functions associated with the transport layer services.

TextBook:

DataCommunicationsandNetworking,Forouzan,5th Edition,McGrawHill,2016 ISBN:1-25-906475-3

Reference Books:

1. ComputerNetworks,JamesJKurose,KeithWRoss,PearsonEducation, 2013, ISBN:0-273-76896-4
2. IntroductiontoDataCommunicationandNetworking,WayarlesTomasi, Pearson Education, 2007, ISBN:0130138282

Web Link and Video Lectures:

1. https://www.classcentral.com/course/fundamentals-network-communications
2. https://www.udacity.com/course/computer-networking--ud436

CELLULAR MOBILE COMMUNICATIONS

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC651**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**

Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS – 03

Course Objectives: This course enables students to:

- Understandtheapplicationofmultiuseraccessinacellularcommunication scenario.
- Understandthepropagationmechanismsinanurbanmobilecommunications using statistical and empiricalmodels.
- Understandsystemarchitecture,callprocessingprotocolsandservicesofGSM, GPRS andEDGE.
- Understand system architecture, call processing protocols and services of CDMA based systems IS95 andCDMA2000.

Module-1

Cellular Concept: Frequency Reuse, Channel Assignment Strategies, Interference andSystemCapacity,PowerControlforReducingInterference,TrunkingandGradeof Service, Improving Capacity in CellularSystems.

Mobile Radio Propagation: Large Scale path Loss- Free Space Model, Three basic propagation mechanisms, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models – Okumura, Hata, PCS Extension to HataModel
(explanations only) (Text 1). **L1, L2**

Module-2

Mobile Radio Propagation: Small-Scale Fading and Multipath:
SmallscaleMultipathPropagation,ImpulseResponseModelofaMultipathChannel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, TypesofSmall-ScaleFading,RayleighandRiceanDistributions,StatisticalModelfor
Multipath Fading Channels (Clarke's Model for Flat Fading only). (Text 1) **L1, L2**

Module-3

System Architecture and Addressing:
System architecture, The SIM concept, Addressing, Registers and subscriber data, Location registers (HLR and VLR) Security-related registers (AUC and EIR), Subscriber data, Network interfaces and configurations.

Air Interface – GSM Physical Layer:
Logical channels, Physical channels, Synchronization- Frequency and clock synchronization, Adaptive frame synchronization, Mapping of logical onto physical channels, Radio subsystem link control,
Channel coding, source coding and speech
processing,Sourcecodingandspeechprocessing,Channelcoding,Power-upscenario. **GSMProtocols:**
Protocol architecture planes, Protocol architecture of the user plane, Protocol architectureofthesignalingplane,Signalingattheairinterface(Um),Signalingatthe
AandAbisinterfaces,Security-relatednetworkfunctions,Signalingattheuser
interface .(Text 2) **L1, L2**

Module-4

GSM Roaming Scenarios and Handover:
Mobile application part interfaces, Location registration and location update, Connectionestablishmentandtermination,Handover.(upto6.4.1onlyinText2) **Services:**
Classical GSM services, Popular GSM services: SMS and MMS.
Improved data services in GSM: **GPRS, HSCSD and EDGE**
GPRS System architecture of GPRS , Services , Session management, mobility managementandrouting,Protocolarchitecture,Signalingplane,InterworkingwithIP networks,Airinterface,Authenticationandciphering,SummaryofGPRS.
HSCSD:Architecture,Airinterface,HSCSDresourceallocationandcapacityissues.
EDGE:TheEDGEconcept,EDGEphysicallayer,modulationandcoding,EDGE: effects on the GSM system architecture, ECSD and EGPRS. (Text 2)**L1, L2**

Module-5

CDMATechnology–IntroductiontoCDMA,CDMAfrequencybands,CDMANetwork andSystemArchitecture,CDMAChannelconcept,ForwardLogicalChannels,Reverse logical Channels, CDMA frame format, CDMA System Operations(Initialization/Registration), Call Establishment, CDMA Call handoff,IS- 95B,CDMA2000,W-CDMA,UMTS,CDMA data networks, Evolution of CDMA to 3G, CDMA2000RANComponents,CDMA2000PacketDataService.(Text3)**L1,L2**

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

- Identify the statistical characterization of urban mobile channels to compute the performance for simple modulation schemes. Identify different modulation Schemes
- Identify the functionalities of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed
- Analyse the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems .Identify different standards
- List and validate voice / data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations
- Examine voice and data call handling for various scenarios CDMA systems for national and international interworking situations

TextBooks:

1. TheodoreRapport,-WirelessCommunications– PrinciplesandPractice‖, Prentice Hall of India , 2nd Edition, 2007, ISBN978-8-120-32381-0.
2. JorgEberspacher,Hans-JorgVogel,ChristianBettstetter,ChristianHartmann, "GSM– Architecture, Protocols and Services‖, Wiley,3rd Edition, 2009,ISBN-978- 0-470-03070-7.
3. GaryJMullet,―IntroductionToWirelessTelecommunicationsSystemsand Networks", Cengage Learning.

ADAPTIVE SIGNALPROCESSING

B.E., VI Semester, Electronics & CommunicationEngineering/ TelecommunicationEngineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC652**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: The objectives of this course are to:

- Introduce to the concept and need of adaptive filters and popular adaptive signal processingalgorithms
- Understand the concepts of training and convergence and the trade-off between performance andcomplexity.
- Introduce to common linear estimation techniques
- Demonstrateapplicationsofadaptivesystemstosampleproblems. Introduce inverse
- adaptivemodelling.

Module-1

Adaptive systems: Definitions and characteristics - applications – properties- examples-adaptivelinearcombinerinputsignalandweightvectors-performance function-gradient and minimum mean square error - introduction to filtering- smoothingandprediction-linearoptimumfiltering-orthogonality-Wiener–Hopf
equation-performance surface(Chapters 1& 2 of Text). **L1,L2**

Module-2

Searching performance surface-stability and rate of convergence: Learning curve- gradient search - Newton's method - method of steepest descent - comparison - Gradientestimation-performancepenalty-variance-excessMSEandtimeconstants
– mis-adjustments (Chapters 4& 5 of Text). **L1, L2**

Module-3

LMSalgorithmconvergenceofweightvector:LMS/Newtonalgorithm-properties-sequentialregressionalgorithm-adaptiverecursivefilters-random-searchalgorithms
- lattice structure - adaptive filters with orthogonal signals (Chapters 6 & 8 of Text).
L1, L2, L3

Module-4

Applications-adaptive modeling and system identification: Multipath communicationchannel,geophysicalexploration,FIRdigitalfiltersynthesis.
(Chapter 9 of Text). **L1, L2, L3**

Module-5

Inverseadaptivemodeling: Equalization,anddeconvolutionadaptiveequalizationof telephonechannels-adaptingpolesandzerosforIIRdigitalfiltersynthesis(Chapter 10 of Text). **L1, L2,L3**

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

- Devise filtering solutions for optimising the cost function indicating error in estimationofparametersandappreciatetheneedforadaptationindesign.
- Evaluate the performance of various methods for designing adaptive filters throughestimationofdifferentparametersofstationaryrandomprocessclearly considering practical application specifications.

Analyse convergence and stability issues associated with adaptive filter design and come up with optimum solutions for real life applications taking care of requirements in terms of complexity and accuracy.

- Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction considering present day challenges.

Text Book:

Bernard Widrow and Samuel D. Stearns, ―Adaptive Signal Processing‖, Person Education, 1985.

Reference Books:

1. SimonHaykin,―AdaptiveFilterTheory‖,PearsonEducation,2003.
2. John R. Treichler, C. Richard Johnson, Michael G. Larimore, ―Theory and DesignofAdaptiveFilters‖,Prentice-HallofIndia,2002.

ARITIFICAL NEURALNETWORKS

B.E., VI Semester, Electronics & Communication Engineering/ TelecommunicationEngineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC653**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of LectureHours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: The objectives of this course are:

- Understand the basics of ANN and comparison with Humanbrain
- Provide knowledge on Generalization and function approximation and various architectures of building anANN
- Provideknowledgeofreinforcementlearningusingneuralnetworks
- Provide knowledge of unsupervised learning using neuralnetworks.

Module-1

Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions– **Architecture**:FeedforwardandFeedback,ConvexSets,ConvexHulland Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.**L1,L2**

Module-2

Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm. **L1, L2,L3**

Module-3

Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory,Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.**L1, L2, L3**

Module-4

AttractorNeuralNetworks:AssociativeLearningAttractorAssociativeMemory,Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.**L1, L2,L3**

Module-5

Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.**L1, L2,L3**

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

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. Understand the concepts and techniques of neural networks through the study of important neural networkmodels.
3. Evaluatewhetherneuralnetworksareappropriatetoaparticularapplication.
4. Apply neural networks to particularapplication.
5. Analyze the steps needed to improve performance of the selected neuralnetwork.

Text Book:

Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. **Introduction to Artificial Neural Systems**-J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks**-B. Yegnanarayana, PHI, New Delhi1998.

DIGITAL SWITCHING SYSTEMS

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC654**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of LectureHours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to

- Understandthebasicsoftelecommunicationnetworksanddigitaltransmissionof data. Studyabouttheevolutionofswitchingsystemsandthedigitalswitching.
- Studyaboutthetelecommunicationtrafficanditsmeasurements.
- Learn the technologies associated with the data switching operations.
- Understand the use of software for the switching and its maintenance.
-

Module-1

DEVELOPMENTOFTELECOMMUNICATIONS: Networkstructure,Networkservices, terminology, Regulation, Standards. Introduction totelecommunications transmission, Powerlevels,Fourwirecircuits,Digitaltransmission,FDM,TDM,PDHandSDH (Text-1) **L1,L2**

Module-2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching.

DIGITAL SWITCHING SYSTEMS: Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Building blocks of a digital switching system, Basic call processing. (Text-1 and 2) **L1, L2**

Module-3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

SWITCHINGSYSTEMS: Introduction,Singlestagenetworks,Gradings,LinkSystems, GOS of Linked systems. (Text-1) **L1, L2**

Module-4

TIMEDIVISIONSWITCHING: Introduction,spaceandtimeswitching,Timeswitching networks,Synchronisation.

SWITCHING SYSTEM SOFTWARE: Introduction, Basic software architecture, Software architecture for level 1to 3 control, Digital switching system software classification, Call models, Software linkages during call, Feature flow diagram, Feature interaction. (Text-1 and 2) **L1, L2**

Module-5

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction , Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, A methodology for proper maintenance of digital switching system

A GENERIC DIGITAL SWITCHING SYSTEMMODEL: Introduction, Hardware

architecture,Softwarearchitecture,Recoverystrategy,Simplecallthroughadigital system,Commoncharacteristicsofdigitalswitchingsystems.Reliabilityanalysis.
(Text-2) **L1, L2**

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

- Identify the basic concepts and parameters of telecommunication networks and services.
- Identify the basic concepts and parameters of telecommunication networks and services.
- Model the traffic flow in lost call systems and queuing systems.
- Organize the digital switching software architecture for various levels of control.
- Identify the software aspects of switching systems and its maintenance.

Text Books:

1. TelecommunicationandSwitching,TrafficandNetworks-JEFlood:Pearson Education,2002.
2. Digital Switching Systems, Syed R. Ali, TMH Ed2002.

Reference Book:

Digital Telephony - John C Bellamy: Wiley India Pvt. Ltd, 3rd Ed, 2008.

MICROELECTRONICS

B.E., VI Semester, Electronics & Communication Engineering [As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC655**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number ofLecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to:

- BefamiliarwiththeMOSFETphysicalstructureandoperation,terminal characteristics,circuitmodelsandbasiccircuitapplications.
- Confrontintegrateddeviceand/orcircuitdesignproblems,identifythedesign issues, and developsolutions.
- Analyzeanddesignmicroelectroniccircuitsforlinearamplifieranddigital applications.
- Contrast the input/output and gain characteristics of single-transistor, differentialandcommontwo-transistorlinearamplifierbuildingblockstages.

Module-1

MOSFETS: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, MOSFET as an amplifier and as a switch. **L1, L2**

Module-2

MOSFETS (continued): Biasing in MOS amplifier Circuits, Small Signal Operation and Models, Basic MOSFET amplifier, MOSFET internal capacitances, frequency response of CS amplifier. **L1, L2**

Module-3

MOSFETS (continued): Discrete circuit MOS amplifiers.
Single Stage IC Amplifier: Comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response- general considerations.
L1, L2, L3

Module-4

SingleStageICAmplifier(continued):CSwithactiveloads,highfrequencyresponse ofCS,CGamplifierswithactiveloads,highfrequencyresponseofCG,Cascode amplifiers. CS with source degeneration (only MOS amplifiers to be dealt). **L1, L2**

Module-5

Differential and Multistage Amplifiers: The MOS differential pair, small signal operation of MOS differential pair, Differential amplifier with active loads, and frequency response of the differential amplifiers. Multistage amplifiers (only MOS amplifiers to be dealt). **L1, L2**

Course outcomes: After studying this course, students will be able to:

- Explain the underlying physics and principles of operation of Metaloxide- semiconductor (MOS) capacitors and MOS field effect transistors(MOSFETs).
- Describeandapplysimplelargesignalcircuitmodelsfor MOSFETs.
- Analyze and design microelectronic circuits for linear amplifier for digital applications.
- UseofdiscreteMOScircuitstodesignSinglestageandMultistageamplifiersto

meet stated operating specifications.

TextBook:

"Microelectronic Circuits", Adel Sedra and K.C. Smith, 6thEdition, Oxford University Press, International Version, 2009.

Reference Books:

1. **"Microelectronics An integrated approach",** Roger T Howe, Charles G Sodini, Pearsoneducation.
2. **"Fundamentals of Microelectronics",** BehzadRazavi, John Wiley India Pvt. Ltd,2008.
3. **"Microelectronics–AnalysisandDesign",**SundaramNatarajan,TataMcGraw- Hill,2007.

EMBEDDED CONTROLLER LAB

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17ECL67**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**01Hr Tutorial(Instructions) + 02 Hours Laboratory = 03**	**SEE Marks**	**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**	**03**

CREDITS – 02

Course objectives: This course will enable students to:

- UnderstandtheinstructionsetofARMCortexM3,a32bitmicrocontrollerandthe softwaretoolrequiredforprogramminginAssemblyandClanguage.
- ProgramARMCortexM3usingthevariousinstructionsinassemblylevellanguage for differentapplications. Interface external devices and I/O with ARM Cortex M3.
- DevelopClanguageprogramsandlibraryfunctionsforembeddedsystem applications.
-

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM CortexM3RegistersusinganEvaluationboardandtherequiredsoftwaretool.

1. ALP to multiply two 16 bit binarynumbers.
2. ALP to find the sum of first 10 integernumbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluationboardusingevaluationversionofEmbedded'C'&KeiluVision-4 tool/compiler.

1. Display―HelloWorld‖messageusingInternalUART.
2. Interface and Control a DCMotor.
3. InterfaceaSteppermotorandrotateitinclockwiseandanti-clockwise direction.

4. InterfaceaDACandgenerateTriangularandSquarewaveforms.
5. Interfacea4x4keyboardanddisplaythekeycodeonanLCD.
6. UsingtheInternalPWMmoduleofARMcontrollergeneratePWMandvaryits dutycycle.
7. Demonstratetheuseofanexternalinterrupttotoggle anLEDOn/Off.
8. DisplaytheHexdigits0toFona7-segmentLEDinterface,withan appropriate delay inbetween.
9. InterfaceasimpleSwitchanddisplayitsstatusthroughRelay,Buzzerand LED.
10. MeasureAmbienttemperatureusingasensorandSPIADCIC.

Course outcomes: After studying this course, students will be able to:

- Apply the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications
- Develop C language programs to interface external devices and I/O with ARM Cortex M3.
- Develop C language programs for embedded system applications.
- Develop C language programs which makes use of library functions for embedded system applications.

Conduction of Practical Examination:

1. PART-BexperimentsusingEmbedded-Careonlytobeconsideredforthepractical examination.PART-AALPprogramsareforstudypurposeandcanbeconsidered for Internal Marksevaluation.
2. Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscriptfor breakup ofmarks.
3. ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.

COMPUTER NETWORKS LAB

B.E., VI Semester, Electronics & Communication Engineering [As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17ECL68**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**01Hr Tutorial(Instructions) + 02 Hours Laboratory = 03**	**SEE Marks**	**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**	**03**

CREDITS – 02

Course objectives: This course will enable students to:

- Choosesuitabletoolstomodelanetworkandunderstandtheprotocolsatvarious OSI referencelevels. Design a suitable network and simulate using a Network simulator tool. Simulate the
- networking concepts and protocols using C/C++ programming. Model the networks for different
- configurations and analyze the results.
-

Laboratory Experiments

PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool

1. Implementapointtopointnetworkwithfournodesandduplexlinksbetweenthem. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implementafournodepointtopointnetworkwithlinksn0-n2,n1-n2andn2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applicationsoverTCPandUDPagentschangingtheparameteranddeterminethe number of packets sent byTCP/UDP.
3. ImplementEthernetLANusingn(6-10)nodes.Comparethethroughputby changing the error rate and datarate.
4. ImplementEthernetLANusingnnodesandassignmultipletraffictothenodesand obtain congestion window for different sources/destinations.
5. ImplementESSwithtransmissionnodesinWirelessLANandobtainthe performanceparameters.
6. Implementation of Link state routingalgorithm.

PART-B: Implement the following in C/C++

1. Write a program for a HLDC frame to perform the following.

i) Bitstuffing

ii) Characterstuffing.

2.Writeaprogramfordistancevectoralgorithmtofindsuitablepathfortransmission.

3. ImplementDijkstra‘salgorithmtocomputetheshortestroutingpath.
4. Forthegivendata,useCRC-CCITTpolynomialtoobtainCRCcode.Verifythe program for thecases
   a. Withouterror
b. Witherror
5. ImplementationofStopandWaitProtocolandSlidingWindowProtocol
6. Writeaprogramforcongestioncontrolusingleakybucketalgorithm.

Courseoutcomes: Onthecompletionofthislaboratorycourse,thestudentswillbe ableto:

Conduct of Practical Examination:

Alllaboratoryexperimentsaretobeincludedforpractical examination.
Forexaminationonequestionfromsoftwareandonequestionfromhardwareor onlyonehardwareexperimentsbasedonthecomplexitytobeset.
Students are allowed to pick one experiment from the lot.
Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscriptfor breakup ofmarks.

- ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be made zero.

6th Semester Open Electives Syllabus for the Courses Offered by EC/TC Board:

DATA STRUCTURE USING C++
B.E VI Semester (Open Elective)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC661**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hrs per Module)**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to

- Explainfundamentalsofdatastructuresandtheirapplicationsessentialfor programming/problemsolving
  AnalyzeLinearDataStructures:Stack,Queues,Lists
- AnalyzeNonLinearDataStructures:Trees
- Assessappropriatedatastructureduringprogramdevelopment/ProblemSolving

Module -1

INTRODUCTION: Functionsandparameters,Dynamicmemoryallocation,Recursion. **LINEAR LISTS:** Data objects and structures, Linear list data structures, Array Representation,VectorRepresentation,SinglyLinkedlistsandchains.**L1,L2**

Module-2

ARRAYS AND MATRICS: Arrays, Matrices, Special matrices, Sparse matrices.

STACKS: Theabstractdatatypes,ArrayRepresentation,LinkedRepresentation, Applications-Parenthesis Matching & Towers of Hanoi. **L1, L2,L3**

Module-3

QUEUES: Theabstractdatatypes,ArrayRepresentation,LinkedRepresentation, Applications-Railroad cararrangement.

HASHING: Dictionaries,Linearrepresentation,Hashtablerepresentation.**L1,L2,L3**

Module-4

BINARYANDOTHERTREES: Trees,Binarytrees,Propertiesandrepresentationof binarytrees,Commonbinarytreeoperations,BinarytreetraversaltheADTbinary tree, ADT binary tree and the class linked binary tree. **L1, L2,L3**

Module-5

Priority Queues: Linear lists, Heaps, Applications-Heap Sorting.
SearchTrees: Binarysearchtreesoperationsandimplementation,BinarySearch trees with duplicates. **L1, L2,L3**

Course outcomes: After studying this course, students will be able to:

- Illustrate the operations of network protocols and algorithms using C programming.
- Utilize the network simulator for learning and practice of networking algorithms.
- Build the network with different configurations to measure the performance parameters.
- Develop the data link and routing protocols using C programming.
- Develop wired and wireless LAN protocol using network simulator

Text Book:

Data structures, Algorithms, and applications in C++, SartajSahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++,** SartajSahni, Mc. Graw Hill,2000.
2. **ObjectOrientedProgrammingwithC++,**E.Balaguruswamy**,**TMH,6thEdition, 2013.
3. **Programming in C++,** E.Balaguruswamy. TMH, 4th,2010.

POWER ELECTRONICS

B.E., VI Semester (Open Elective, *not for E&C students*) [As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC662**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

CourseObjectives: Thiscoursewillenablestudentsto

- Understandtheworkingofvariouspowerdevices.
- Studyandanalysisofthyristorcircuitswithdifferenttriggeringtechniques. Learn the applications of
- power devices in controlled rectifiers, convertersand inverters.
- Studyofpowerelectronicscircuitsunderdifferentloadconditions.

Module-1

Introduction-ApplicationsofPowerElectronics,PowerSemiconductorDevices,Control CharacteristicsofPowerDevices,typesofPowerElectronicCircuits.
PowerTransistors:PowerBJTs:Steadystatecharacteristics.PowerMOSFETs:device operation,switchingcharacteristics,IGBTs:deviceoperation,outputandtransfer characteristics. (Text 1) **L1, L2**

Module-2

Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types, Gate Trigger Circuit: Resistance Firing
Circuit, Resistance capacitance firing circuit. (Text 2) **L1, L2, L3**

Module-3

ControlledRectifiers-Introduction,principleofphasecontrolledconverteroperation, Single phase full converters, Single phase dualconverters.
ACVoltageControllers-Introduction,PrinciplesofON-OFFControl,PrincipleofPhase Control, Single phase control with resistive and inductive loads. (Text 1) **L1, L2, L3**

Module-4

DC-DC Converters - Introduction, principle of step-down operation and it‘s analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators:Buck
regulator, Boost regulator, Buck-Boost Regulators. (Text 1) **L1, L2**

Module-5

Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter. (Text 1) **L1,L2**

Course outcomes: After studying this course, students will be able to:

- Describe the characteristics of different power devices and identifythe applications. Illustrate the working of DC-DC converter and inverter circuit.
- Determinetheoutputresponseofathyristorcircuitwithvarioustriggering options.
- Determinetheresponseofcontrolledrectifierwithresistiveandinductiveloads.

Evaluation of CIE Marks:

ItissuggestedthatatleastafewexperimentsofPowerElectronicsareconductedbythe studentsforbetterunderstandingofthecourse.Thisactivitycanbeconsideredforthe evaluationof10marksoutof40CIE(ContinuousInternalEvaluation)marks,reserved for the otheractivities.

Question paper pattern:

- Thequestionpaperwillhavetenquestions.

Eachfullquestionconsistsof16marks.

- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.

Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom each module

Text Book:

1. MohammadHRashid,PowerElectronics,Circuits,DevicesandApplications, 3rd/4thEdition,PearsonEducationInc,2014,ISBN:978-93-325-1844-5.
2. M.DSinghandKBKhanchandani,PowerElectronics,2ndEdition,TataMc-Graw Hill, 2009, ISBN:0070583897.

Reference Books:

4. L.Umanand,PowerElectronics,EssentialsandApplications,JohnWileyIndia Pvt. Ltd,2009.
5. Dr.P.S.Bimbhra,―PowerElectronics‖,KhannaPublishers,Delhi,2012.
6. P.C.Sen,―ModernPowerElectronics‖,SChand&CoNewDelhi,2005.

DIGITAL SYSTEM DESIGN USING VERILOG

B.E., VI Semester (Open Elective)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code:	**17EC663**	**CIE Marks: 40**
Number of Lecture Hours/Week:	**03**	**SEE Marks: 60**
Total Number of Lecture Hours:	**40 (08 Hrs per module)**	**Exam Hours: 03**

CREDITS – 03

CourseObjectives: Thiscoursewillenablestudentsto

- UnderstandtheconceptsofVerilogLanguage.
- Designthedigitalsystemsasanactivityinalargersystemsdesigncontext. Study the design and operation of semiconductor memories frequently used in application specific digitalsystem.
- InspecthoweffectivelyIC‘sareembeddedinpackageandassembledin PCB‘s for differentapplication.
- DesignanddiagnosisofprocessorsandI/Ocontrollersusedinembeddedsystems.

Module -1

Introduction and Methodology:
DigitalSystemsandEmbeddedSystems,Real-WorldCircuits,Models,Design Methodology (1.1, 1.3 to 1.5 ofText).

CombinationalBasics: CombinationalComponentsandCircuits,Verificationof Combinational Circuits.(2.3 and 2.4 ofText)

Sequential Basics: Sequential Datapaths and Control Clocked Synchronous Timing Methodology (4.3 up to 4.3.1,4.4 up to 4.4.1 of Text). **L1, L2, L3**

Module -2

Memories: Concepts, Memory Types, Error Detection and Correction (Chap 5 of Text). **L1, L2, L3**

Module -3

Implementation Fabrics: Integrated Circuits, Programmable Logic Devices, Packaging and Circuit boards, Interconnection and Signal integrity (Chap 6 of Text). **L1, L2, L3**

Module -4

I/Ointerfacing: I/Odevices,I/Ocontrollers,ParallelBuses,SerialTransmission,I/O software (Chap 8 of Text). **L1, L2,L3**

Module -5

DesignMethodology: Designflow,Designoptimization,Designfortest,Nontechnical Issues (Chap 10 of Text). **L1, L2, L3,L4**

Course outcomes: After studying this course, students will be able to:

- Construct the combinational circuits, using discrete gates and programmable logic devices
- Build Verilog model for sequential circuits and test pattern generation
- Design a semiconductor memory for specific chip design
- Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores
- Analyse different types of processor and I/O controllers that are used in embedded system

Text Book:

PeterJ.Ashenden,-DigitalDesign:AnEmbeddedSystemsApproachUsingVERILOG‖, Elesvier,2010.

B.E E&C EIGTH SEMESTER SYLLABUS

WIRELESS CELLULAR and LTE 4G BROADBAND

B.E., VIII Semester, Electronics &Communication Engineering/ Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC81**	**CIE Marks**	**40**
Number of Lecture	**04**	**SEE Marks**	**60**
Total Number	**50 (10 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 04

Course Objectives: This course will enable students to:

- UnderstandthebasicsofLTEstandardizationphasesandspecifications.
- ExplainthesystemarchitectureofLTEandE-UTRAN,thelayerofLTE, basedontheuseofOFDMAandSC-FDMAprinciples.
- AnalyzetheroleofLTEradiointerfaceprotocolstosetup,reconfigureand releasetheRadioBearer,fortransferringtheEPSbearer.
- AnalyzethemainfactorsaffectingLTEperformanceincludingmobilespeed and transmissionbandwidth.

Module – 1

Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).

WirelessFundamentals: Cellularconcept,Broadbandwirelesschannel(BWC), FadinginBWC,ModelingBWC–EmpiricalandStatisticalmodels,Mitigationof Narrow band and Broadband Fading (Sec 2.2 – 2.7of Text). **L1,L2**

Module – 2

MulticarrierModulation:OFDMbasics,OFDMinLTE,TimingandFrequency Synchronization, PAR, SC-FDE (Sec 3.2 – 3.6 ofText).

OFDMA and SC-FDMA:OFDM with FDMA,TDMA,CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 – 4.3, 4.5 of Text).

Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference
suppression and Spatial Multiplexing (Sec 5.1 – 5.6 of Text). **L1, L2**

Module – 3

Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).

Downlink Transport Channel Processing: Overview, Downlink shared

channels,DownlinkControlChannels,Broadcastchannels,Multicastchannels, Downlinkphysicalchannels,H-ARQonDownlink(Sec7.1–7.7ofText).**L1,L2**

Module – 4

Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).

Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channelsounding,BufferstatusReportinginuplink,SchedulingandResource Allocation,CellSearch,RandomAccessProcedures,PowerControlinuplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text). **L1,L2**

Module – 5

Radio Resource Management and Mobility Management:
PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter- cell Interference Coordination (Sec 10.1 – 10.5 of Text). **L1, L2**

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

- Make use of the system architecture and the functional standard specified in LTE 4G.
- Identify the role of the layer of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
- Utilize the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
- Identify the difference between uplink , down link and the physical layer procedures that provide the services to upper layers.
- Utilize the Performance of resource management and packet data processing and transport algorithms.

Text Book:

Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed,
_Fundamentals of LTE‘, Prentice Hall, Communications Engg. and Emerging Technologies.

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced‘ HarriHolma and AnttiToskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. _EVOLVEDPACKETSYSTEM(EPS);THELTEANDSAEEVOLUTION OF 3G UMTS‘ by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. PrintISBN:978-0-470-05976-0.
3. _LTE – The UMTS Long Term Evolution ; From Theory to Practice‘ by StefaniaSesia,IssamToufik,andMatthewBaker,2009JohnWiley&Sons Ltd, ISBN978-0-470-69716-0.

FIBER OPTICS and NETWORKS

B.E., VIII Semester, Electronics &Communication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC82**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**4**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 04

Course Objectives: This course will enable students to:

- Learnthebasicprincipleofopticalfibercommunicationwithdifferent modes of lightpropagation.
- Understand the transmission characteristics and losses in optical fiber.
- Studyofopticalcomponentsanditsapplicationsinopticalcommunication networks.
- Learnthenetworkstandardsinopticalfiberandunderstandthenetwork architectures along with itsfunctionalities.

Module -1

OpticalfiberCommunications: Historicaldevelopment,Thegeneralsystem, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindricalfiber:Modes,Stepindexfibers,Gradedindexfibers,Singlemode fibers,Cutoffwavelength,Modefielddiameter,effectiverefractiveindex.Fiber Materials, Photonic crystal fibers. (Text 2) **L1, L2**

Module -2

Transmission characteristics of optical fiber: Attenuation, Material absorptionlosses,Linearscatteringlosses,Nonlinearscatteringlosses,Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step indexfiber.

Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2) **L1, L2**

Module -3

Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emittingdiodes:LEDStructures,LightSourceMaterials,QuantumEfficiency andLEDPower,Modulation.LaserDiodes:ModesandThresholdconditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser DiodestructuresandRadiationPatterns:Singlemodelasers.

Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.

Optical Receiver: Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1) **L1, L2**

Module -4

WDMConceptsandComponents: OverviewofWDM:OperationalPrinciples of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators andCirculators,Fibergratingfilters,DielectricThin-FilmFilters,Diffraction Gratings, Active Optical Components, Tunable lightsources,

Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1) **L1, L2**

Module -5

Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI referencemodel, Opticaltransportnetwork,Internetprotocol,Wavelengthroutingnetworks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropoliton area networks, Access networks, Local area networks. (Text 2) **L1,L2**

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

- Make use of the concepts of optical fibre explain the working of optical fibre with different modes of light propagation.
- Utilize the concepts of transmission characteristics to obtain the losses in optical fiber communication.
- Identify the construction and working principle of optical connectors, multiplexers and amplifiers.
- Analyze the constructional features and the characteristics of optical sources and detectors.
- Examine the networking aspects of optical fiber and describe various standards associated with it.

Text Books:

1. GerdKeiser,OpticalFiberCommunication,5th Edition,McGrawHill Education(India)PrivateLimited,2015.ISBN:1-25-900687-5.
2. JohnMSenior,OpticalFiberCommunications,PrinciplesandPractice,3rd Edition, Pearson Education, 2010,ISBN:978-81-317-3266-3

Reference Book:

JosephCPalais,FiberOpticCommunication,PearsonEducation,2005, ISBN:0130085103

MICRO ELECTRO MECHANICAL SYSTEMS

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC831**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to:

- Understand overview of microsystems, their fabrication and applicationareas.
- Working principles of several MEMSdevices.
- Develop mathematical and analytical models ofMEMSdevices.
- Know methods to fabricate MEMSdevices.
- VariousapplicationareaswhereMEMSdevicescanbeused.

Module 1

Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of
Microsystems, Miniaturization. Applications and Markets. **L1, L2**

Module 2

Working Principles of Microsystems: Introduction, Microsensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics.

Engineering Science for Microsystems Design and Fabrication: Introduction, Molecular Theory of Matter and Inter-molecular Forces, Plasma Physics, Electrochemistry. **L1, L2**

Module 3

Engineering Mechanics for Microsystems Design: Introduction, Static BendingofThinPlates,MechanicalVibration,Thermomechanics,Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis. **L1, L2,L3**

Module 4

Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, ScalinginRigid-BodyDynamics,ScalinginElectrostaticForces,Scalingin FluidMechanics,ScalinginHeatTransfer. **L1, L2,L3**

Module 5

OverviewofMicromanufacturing: Introduction,BulkMicromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micromanufacturing. **L1,L2**

Course Outcomes: After studying this course, students will be able to:

- AppreciatethetechnologiesrelatedtoMicroElectroMechanicalSystems.
- Understand design and fabrication processes involved with MEMS devices.
- AnalysetheMEMSdevicesanddevelopsuitablemathematicalmodels
- Know various application areas for MEMSdevice

Text Book:

Tai-RanHsu,MEMSandMicrosystems:Design,Manufactureand Nanoscale Engineering, 2nd Ed,Wiley.

Reference Books:

1. HansH.Gatzen,VolkerSaile,JurgLeuthold,MicroandNano Fabrication:ToolsandProcesses,Springer,2015.
2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, MicroelectromechanicalSystems(MEMS),CenageLearning.

SPEECH PROCESSING

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC832**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

CourseObjectives: Thiscourseenablesstudentsto:

- Introducethemodelsforspeechproduction
- Developtimeandfrequencydomaintechniquesforestimatingspeechparameters Introduce a predictive
- technique for speechcompression
- Providefundamentalknowledgerequiredtounderstandandanalysespeech recognition, synthesis and speaker identification systems.

Module-1

Fundamentals of Human Speech Production: The Process of Speech Production, Short-Time Fourier Representation of Speech, The Acoustic Theory of Speech Production, Lossless Tube Models of the Vocal Tract, Digital Models for Sampled
Speech Signals. **L1, L2**

Module-2

Time-Domain Methods for Speech Processing: Introduction to Short-Time Analysis ofSpeech,Short-TimeEnergyandShort-TimeMagnitude,Short-TimeZero-Crossing Rate, The Short-Time Autocorrelation Function, The Modified Short-Time AutocorrelationFunction,TheShort-TimeAverageMagnitudeDifferenceFunction.

L1, L2

Module-3

Frequency Domain Representations: Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Spectrographic Displays, Overlap Addition(OLA),Method of Synthesis,FilterBankSummation(FBS)MethodofSynthesis,Time-DecimatedFilter Banks,Two-ChannelFilterBanks,ImplementationoftheFBSMethodUsingtheFFT, OLA Revisited, Modifications of the STFT. **L1,L2**

Module-4

The Cepstrum and Homomorphic Speech Processing: Homomorphic Systems for Convolution,HomomorphicAnalysisoftheSpeechModel,ComputingtheShort-Time Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech,CepstrumAnalysisofAll-PoleModels,CepstrumDistanceMeasures.**L1,L2,**
L3

Module-5

Linear Predictive Analysis of Speech Signals: Basic Principles of Linear Predictive Analysis,ComputationoftheGainfortheModel,FrequencyDomainInterpretationsof LinearPredictiveAnalysis,SolutionoftheLPCEquations,ThePredictionErrorSignal, SomePropertiesoftheLPCPolynomialA(z),RelationofLinearPredictiveAnalysisto

Lossless Tube Models, Alternative Representations of the LP Parameters. **L1, L2, L3**

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

- Modelspeechproductionsystemanddescribethefundamentalsofspeech. Extract and compare
- different speechparameters.
- Choose an appropriate speech model for a given application.
- Analyse speech recognition, synthesis and speaker identification systems

Text Book:

TheoryandApplicationsofDigitalSpeechProcessing-RabinerandSchafer, Pearson Education2011

Reference Books:

1. **FundamentalsofSpeechRecognition**-LawrenceRabinerandBiing-Hwang Juang, Pearson Education,2003.

2. **Speech and Language Processing–An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition**-Daniel Jurafsky and James H Martin, Pearson Prentice Hall2009.

RADAR ENGINEERING

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC833**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the Radar fundamentals and analyze the radar signals.
- Understand various technologies involved in the design of radar transmitters and receivers.
- LearnvariousradarslikeMTI,Dopplerandtrackingradarsandtheircomparison

Module-1

Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitionswithrespecttopulsewaveform-PRF,PRI,DutyCycle,PeakTransmitter Power, Average transmitterPower.

Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1ofText)

L1, L2,L3

Module-2

TheRadarEquation: PredictionofRangePerformance,DetectionofsignalinNoise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, EnvelopeDetector—FalseAlarmTimeandProbability,ProbabilityofDetection,

Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11) **L1, L2, L3**

Module-3

MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, SimpleCWRadar,SweeptoSweepsubtractionandDelayLineCanceler,MTIRadar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Responseof Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-LineCanceler,

DigitalMTIProcessing–Blindphases,IandQChannels,DigitalMTIDopplersignal processor,MovingTargetDetector-OriginalMTD.(Chapter3:3.1,3.2,3.5,3.6ofText)

L1, L2, L3

Module-4

Tracking Radar:

Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), PhaseComparison Monopulse.

SequentialLobing,ConicalScanTracking,BlockDiagramofConicalScanTracking Radar,TrackinginRange,ComparisonofTrackers.(Chapter4:4.1,4.2,4.3ofText) **L1, L2,L3**

Module-5

TheRadarAntenna: FunctionsofTheRadarAntenna,AntennaParameters,Reflector AntennasandElectronicallySteeredPhasedarrayAntennas**.**(Chapter9:9.1,9.29.4,

9.5 of Text)
Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver,DuplexersandReceiversProtectors,RadarDisplays.(Chapter11ofText) **L1, L2,L3**

Courseoutcomes: Attheendofthecourse,studentswillbeableto:

- Understandtheradarfundamentalsandradarsignals.
- Explain the working principle of pulse Doppler radars, their applications and limitations Describe the working of various radar transmitters and receivers.
- Analyze the range parameters of pulse radar system which affect the system performance
-

Text Book:

Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.

Reference Books:

1. Radar Principles, Technology, Applications — Byron Edde, PearsonEducation, 2004.
2. RadarPrinciples–Peebles.Jr,P.Z.Wiley.NewYork,1998.
3. PrinciplesofModemRadar:BasicPrinciples–MarkA.Rkhards,JamesA. Scheer, William A. HoIm. Yesdee, 2013

MACHINE LEARNING

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC834**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to:

- IntroducesomeconceptsandtechniquesthatarecoretoMachineLearning.
- Understand learning and decisiontrees.
- Acquireknowledgeofneuralnetworks,Bayesiantechniquesandinstantbased learning.
- Understand analytical learning and reinforcedlearning.

Module-1

Learning: Designing Learning systems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Elimination Algorithm, Inductive bias. **L1,L2**

Module-2

Decision Tree and ANN: Decision Tree Representation, Hypothesis Space Search, Inductivebiasindecisiontree,issuesinDecisiontree.NeuralNetworkRepresentation, Perceptrons,MultilayerNetworksandBackPropagationAlgorithms.**L1,L2**

Module-3

Bayesian and Computational Learning: Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier. **L1, L2**

Module-4

Instant Based Learning and Learning set of rules: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning.
Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules. **L1, L2**

Module-5

Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning. **L1, L2**

Courseoutcomes: Attheendofthecourse,studentsshouldbeableto:

- UnderstandthecoreconceptsofMachinelearning.
- Appreciatetheunderlyingmathematicalrelationshipswithinandacross Machine Learningalgorithms.
- Explain paradigms of supervised and un-supervised learning.
- RecognizearealworldproblemandapplythelearnedtechniquesofMachine Learning to solve theproblem.

Text Book:

MachineLearning-TomM.Mitchell,McGraw-HillEducation,(IndianEdition), 2013.

Reference Books:

1. **IntroductiontoMachineLearning-**EthemAlpaydin,2ndEd.,PHILearningPvt. Ltd.,2013.
2. **TheElementsofStatisticalLearning-**T.Hastie,R.Tibshirani,J.H.Friedman, Springer; 1st edition,2001.

NETWORK AND CYBER SECURITY

B.E., VIII Semester, Electronics & Communication Engineering
[As per Choice Based credit System (CBCS) Scheme]

Course Code	**17EC835**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**ExamHours**	**03**

CREDITS – 03

Course Objectives: This course will enable students to:

- KnowaboutsecurityconcernsinEmailandInternetProtocol. Understand cyber
- securityconcepts.
- Listtheproblemsthatcanariseincybersecurity.
- Discussthevariouscybersecurityframework.

Module-1

Transport Level Security: Web Security Considerations, Secure Sockets Layer,TransportLayerSecurity,HTTPS,SecureShell(SSH)(Text1:Chapter 15). **L1,L2**

Module-2

E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail (Text 1: Chapter 17). **L1, L2**

Module-3

IPSecurity:IPSecurityOverview,IPSecurityPolicy,EncapsulationSecurity Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites(Text 1: Chapter 18.) **L1,L2**

Module-4

Cyber network security concepts: Security Architecture, antipattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy based malware detection.

Theproblems:cyberantipatternsconcept,forcesincyberantipatterns,cyber antipatterntemplates,cybersecurityantipatterncatalog(Text-2:Chapter1& 2). **L1, L2,L3**

Module-5

Cyber network security concepts contd. :
Enterprise security using Zachman framework
Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop,matrixmining,minipatternsforproblemsolvingmeetings.
Case study: cyber security hands on – managing administrations and root accounts, installing hardware, reimaging OS, installing system protection/ antimalware,configuringfirewalls(Text-2:Chapter3&4).**L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:

- Explain network security protocols
- Understandthebasicconceptsofcybersecurity Discuss the
- cyber securityproblems
- Explain Enterprise Security Framework
- Applyconceptofcybersecurityframeworkincomputersystem administration

Text Books:

1. William Stallings, ―Cryptography and Network Security Principles and Practice‖,PearsonEducationInc.,6thEdition,2014,ISBN:978-93-325- 1877-3.

2. Thomas J. Mowbray, ―Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions‖,Wiley.

Reference Books:

1. CryptographyandNetworkSecurity,BehrouzA.Forouzan,TMH,2007.
2. CryptographyandNetworkSecurity,AtulKahate,TMH,2003.