**K.S. INSTITUTE OF TECHNOLOGY, BANGALORE**
***(AFFLIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM)***

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.**

**ENGINEERING MATHEMATICS-III**

**(Common to all Branches)**

**Course Title: Engineering Mathematics-III** | **Course Code :15MAT31**
**Credits:04** | **L-T-P :4-0-0**
**Contact Hours/Week: 04** | **Total Hours:50**
**Exam. Marks:80** | **IA Marks :20**
**Exam. Hours: 03**

| Modules | RBT Level |
|---|---|
| Module-1 | |
| Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period $2\pi$ and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field. | L1, L2, L4 |
| Module-2 | |
| Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform.<br>Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations. | L2, L3, L4 |
| Module-3 | |
| Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –Problems<br>Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$.<br>Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. | L3 |
| Module-4 | |
| Finite differences : Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae withoutproof)-Problems.<br>Numerical integration:Simpson's $(1/3)^{th}$and $(3/8)^{th}$rules, Weddle's rule (without proof )–Problems. | L3 |

| Module-5 | |
|---|---|
| Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems.<br>Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems. | L3,L4<br><br>L2,L4 |
| Course outcomes: On completion of this course, students are able to:<br>• Make use of Fourier series to analyze wave forms of periodic functions<br>• Make use of Fourier transforms and Z - transforms to analyze wave forms of non periodic functions.<br>• Identify statistical methods to find correlation and regression lines, also numerical methods to solve transcendental equations.<br>• Utilize Numerical techniques for various finite difference technique problem.<br>• Construct Greens, divergence and Stokes theorems for various engineering applications. | |
| Question paper pattern:<br>• The question paper will have tenquestions.<br>• Each full Question consisting of 16marks<br>• Therewillbe2fullquestions(withamaximumoffoursubquestions)fromeach module.<br>• Eachfullquestionwillhavesubquestionscoveringallthetopicsundera module.<br>• Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule. | |
| Text Books:<br>1. *B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed.,2015.*<br>2. *E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons,10th Ed.,2015.* | |
| Reference Books:<br>1. *N.P.Bali and Manish Goyal: A Text Book ofEngineering Mathematics, Laxmi Publishers, 7th Ed.,2010.*<br>2. *B.V.Ramana:"HigherEngineeringMathematics"TataMcGraw-Hill,2006.*<br>3. *H. K. Dass and Er. RajnishVerma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition,2011.* | |
| Web Link and Video Lectures:<br>1. *http://nptel.ac.in/courses.php?disciplineID=111*<br>2. *http://www.khanacademy.org/*<br>3. *http://www.class-central.com/subject/math* | |

ADDITIONAL MATHEMATICS - I

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

(A Bridge course for Lateral Entry students of III Sem. B. E.)

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

| | | | |
|---|---|---|---|
| Subject Code | 15MATDIP31 | IA Marks | -- |
| Number of Lecture Hours/Week | 03 | Exam marks | 80 |
| Total Number of Lecture Hours | 40 (08 Hours per Module) | | |

Credits – 00

Course Objectives: This course will enable students to:

- Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vectordifferentiation.
- Solve first order differentialequations.

| Modules | RBT Level |
|---|---|
| Module-1 | |
| Complex Trigonometry : Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De- Moivre's theorem (without proof).<br><br>Vector Algebra : Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vectortriple products-simpleproblems. | L1 |
| Module-2 | |
| Differential Calculus : Review of successive differentiation. Formulae for $n^{th}$derivatives of standard functions- Liebnitz's theorem (without proof). Polar curves–angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application toJacobians. | L1, L2 |
| Module-3 | |
| Integral Calculus: Statement of reduction formulae for $sin^n x$, $cos^n x$, *and* $sin^m x\ cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals-Simpleexamples. | L1, L2 |
| Module-4 | |
| Vector Differentiation : Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vectorpoint functions. Gradient, Divergence, Curl and Laplacian (Definitionsonly).<br>Solenoidal and irrotational vector fields-Problems. | L1, L2 |
| Module-5 | |
| Ordinary differential equations (ODE's): Introduction-solutions offirst order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to abovetypes. | L1, L2 |

| | |
|---|---|
| Course outcomes: On completion of the course, students are able to:<br>• Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in relatedarea.<br>• Use derivatives and partial derivatives to calculate rates of change of multivariatefunctions.<br>• Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region.<br>• Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valuedfunctions.<br>• Recognizeandsolvefirst-orderordinarydifferentialequationsoccurring in different branches ofengineering. | |
| Question paper pattern:<br>• The question paper will have tenquestions.<br>• Each full Question consisting of 16marks<br>• Therewillbe2fullquestions(withamaximumoffoursub questions) from eachmodule.<br>• Eachfullquestionwillhavesubquestionscoveringallthetopics under amodule.<br>• Thestudentswillhavetoanswer5fullquestions,selectingonefull question from eachmodule. | |
| Text Book :<br>*B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.* | |
| Reference Books:<br>1. *E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.,2015.*<br>2. *N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed.,2007.* | |

ANALOG ELECTRONICS
[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III(EC/TC)

| | | | |
|---|---|---|---|
| Subject Code | 15EC32 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours per Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- Explain various BJT parameters, connections andconfigurations.
- Explain BJT Amplifier, Hybrid Equivalent and HybridModels.
- Explain construction and characteristics of JFETs andMOSFETs.
- ExplainvarioustypesofFETbiasing,anddemonstratetheuseofFETamplifiers.
- ConstructfrequencyresponseofBJTandFETamplifiersatvariousfrequencies.
- Analyze Power amplifier circuits in different modes ofoperation.
- Construct Feedback and Oscillator circuits usingFET.

| Modules | RBT Level |
|---|---|
| Module -1 | |
| BJT AC Analysis: BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid π Model. | L1, L2,L3 |
| Module -2 | |
| Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.<br>FET Amplifiers: JFET small signal model, Fixed bias configuration, Self bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration. | L1, L2, L3 |
| Module -3 | |
| BJT and JFET Frequency Response: Logarithms, Decibels, Low frequency response – BJT Amplifier with RL, Low frequency response- FET Amplifier, Miller effect capacitance, High frequency response –BJT Amplifier,Highfrequencyresponse-FETAmplifier,MultistageFrequency Effects. | L1, L2, L3 |
| Module -4 | |

| | |
|---|---|
| Feedback and Oscillator Circuits: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wien bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator. | L1,L2, L3 |
| Module -5 | |
| Power Amplifiers: Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers. Voltage Regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators. | L1, L2, L3 |

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

- Identify the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers.
- Construct the Phase shift, Wien bridge, tuned and crystal Oscillators using BJT/FET/UJT.
- Solve for the AC gain and impedance for BJT using re and h
- Parameters models for CE and CC configuration.
- Identify the performance characteristics and parameters of BJT and FET amplifier using small signal model.
- Determine parameters which affect low frequency and high frequency responses of BJT and FET amplifiers. Compare efficiency of Class A and Class B power amplifiers and voltage regulators.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule. Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Book:

Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.

Reference Books:

1. AdelS.SedraandKennethC.Smith,"MicroElectronicCircuitsTheoryand Application", 5th EditionISBN:0198062257
2. FundamentalsofMicroelectronics,BehzadRazavi,JohnWeilyISBN2013978-81- 265-2307-8
3. J.Millman&C.C.Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0- 07-462245-5
4. K.A.Navas,"ElectronicsLabManual",VolumeI,PHI,5thEdition,2015, ISBN:9788120351424.

Web Link and Video Lectures:

1. https://www.classcentral.com/course/swayam-analog-circuits
2. https://swayam.gov.in/nd1_noc19_ee38/preview

DIGITAL ELECTRONICS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| Subject Code | 15EC33 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours per Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- IllustratesimplificationofAlgebraicequationsusingKarnaughMapsandQuine- McCluskyTechniques.
- Design combinational logiccircuits.
- DesignDecoders,Encoders,DigitalMultiplexer,Adders,SubtractorsandBinary Comparators.
- Describe Latches and Flip-flops, Registers andCounters.
- Analyze Mealy and MooreModels.
- Develop state diagrams Synchronous SequentialCircuits.

| Modules | RBT Level |
|---|---|
| Module – 1 | |
| Principles of combination logic : Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables.(Text 1, Chapter 3) | L1, L2, L3 |
| Module -2 | |
| Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers,UsingmultiplexersasBooleanfunctiongenerators,Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.(Text 1, Chapter4) | L1, L2, L3 |
| Module -3 | |
| Flip-Flops:BasicBistableelements,Latches,Timingconsiderations,The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops,JK flip- flops,Edgetriggeredflip-flops,Characteristicequations.(Text2,Chapter 6) | L1,L2 |
| Module -4 | |
| Simple Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers,Design of a synchronous counters, Design of a synchronous mod-n counter usingclockedT,JK,DandSRflip-flops.(Text2,Chapter6) | L1,L2 , L3 |

| Module -5 | |
|---|---|
| Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams,counterdesign. (Text 1, Chapter6) | L1, L2, L3 |

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

- Apply Boolean algebra and Karnaugh Map to analyze combinational digital circuits.
- Apply Quine Mc-Cluskey technique for minimization of Boolean expression to get minimal SOP and POS Forms.
- Analyze and design combinational digital electronic circuits to meet the given Specifications/Constraints.
- Model Sequential circuit by understanding the working of basic components used in Sequential circuits.
- Analyze and develop state diagram, state table, state equation for Mealy and Moore Finite state machine.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule. Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books:


1. DigitalLogicApplicationsandDesign,JohnMYarbrough,ThomsonLearning, 2001. ISBN981-240-062-1.
2. DonaldD.Givone,"DigitalPrinciplesandDesign",McGrawHill,2002.ISBN978-0- 07-052906-9.


Reference Books:


1. D.P.KothariandJ.SDhillon,"DigitalCircuitsandDesign",Pearson,2016, ISBN:9789332543539.
2. MorrisMano,"DigitalDesign",PrenticeHallofIndia,ThirdEdition.
3. CharlesHRoth,Jr.,"Fundamentalsoflogicdesign",CengageLearning.
4. K.A.Navas,"ElectronicsLabManual",VolumeI,PHI,5th Edition,2015,ISBN: 9788120351424.


Web Link and Video Lectures:

1. https://swayam.gov.in/nd1_noc19_ee51/preview.
2. https://www.edx.org/learn/electronics

NETWORK ANALYSIS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| Subject Code | 15EC34 | IA Marks | 20 |
| Number | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours per Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course enables students to:

- Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current andpower.
- Explain network Thevenin's, Millman's, Superposition, Reciprocity, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to ElectricalCircuits.
- Explainthebehaviorofnetworkssubjectedtotransientconditions.
- Use applications of Laplace transforms to networkproblems.
- Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequencyresponse.
- StudytwoportnetworkparameterslikeZ,Y,Tandhandtheirinter-relationships andapplications.

| Modules | RBT Level |
|---|---|
| Module -1 | |
| Basic Concepts: Practical sources, Source transformations, Network reductionusingStar–Deltatransformation,Loopandnodeanalysiswith linearly dependent and independent sources for DC and AC networks, Concepts of super node and supermesh. | L1, L2,L3,L4 |
| Module -2 | |
| Network Theorems: Superposition,Reciprocity,Millman'stheorems,Thevinin'sandNorton's theorems, Maximum Power transfertheorem. | L1, L2, L3,L4 |
| Module -3 | |
| Transient behavior and initial conditions: Behavior of circuitelements underswitchingconditionandtheirRepresentation,evaluationofinitial and final conditions in RL, RC and RLC circuits for AC and DC excitations.<br>Laplace Transformation &Applications : Solution of networks, step, ramp and impulse responses, waveform Synthesis. | L1, L2, L3,L4 |
| Module -4 | |
| Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q–Factor, Bandwidth. | L1, L2, L3,L4 |
| Module -5 | |

| | |
|---|---|
| Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets. | L1, L2, L3,L4 |

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

- Make use of different transformation techniques and Mesh & Nodal nodal analysis to analyse DC and AC electrical circuits.
- Solve for current/voltage in electrical circuits by applying network theorems.
- Make use of Laplace transform to calculate current and voltages for the given circuit under transient conditions.
- Solve for different parameters in resonant circuits.
- Solve the given network using specified two port network parameters.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books:


1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN:9780136110958.
2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN:9788122427677.


Reference Books:


1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010.
2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8th ed,2006.
3. Charles K Alexander and Mathew N O Sadiku, " Fundamentals of Electric Circuits", Tata McGraw-Hill, 3rd Ed,2009.


Web Link and Video Lectures:

1. https://www.udemy.com/course/full-course-circuit-analysis/
2. https://www.khanacademy.org/science/electrical-engineering

ELECTRONIC INSTRUMENTATION

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

SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| Subject Code | 15EC35 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours per Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- Defineanddescribeaccuracyandprecision,typesoferrors,statisticaland probability analysis.
- DescribetheoperationofAmmeters,Voltmeters,Multimetersanddevelop circuits for multirange Ammeters andVoltmeters.
- DescribefunctionalconceptsandoperationofvariousAnalogandDigital measuringinstruments.
- DescribebasicconceptsandoperationofDigitalVoltmetersandMicroprocessor basedinstruments.
- DescribeanddiscussfunctioningandtypesofOscilloscopes,Signalgenerators, AC and DC bridges.
- Recognize and describe significance and working of different types of transducers.

| Modules | RBT Level |
|---|---|
| Module -1<br>Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations, Basics of Statistical Analysis. (Text 2)<br><br>Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)<br><br>Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. Transistor Voltmeter, Differential Voltmeter, True RMS Voltmeter, Considerations in Choosing an Analog Voltmeter, Multimeter. (Text 1) | L1, L2, L3 |
| Module -2 | |

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|---|---|
| DigitalVoltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Continuous Balance DVM, $3\frac{1}{2}$-Digit, Resolution and Sensitivity of Digital Meters, General SpecificationsofDVM,MicroprocessorbasedRamptypeDVM.(Text1)<br><br>Digital Instruments: Introduction, Digital Multimeters, Digital FrequencyMeter,DigitalMeasurementofTime,UniversalCounter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital CapacitanceMeter,MicroprocessorbasedInstruments.(Text1) | L1, L2,L3 |
| Module -3 | |
| Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, StorageOscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text1)<br><br>Signal Generators: Introduction, Fixed and Variable AF Oscillator, StandardSignalGenerator,LaboratoryTypeSignalGenerator,AFsine and Square Wave Generator, Function Generator, Square and Pulse Generator, Sweep Generator. (Text1) | L1, L2 |
| Module -4 | |
| Measuring Instruments: Output Power Meters, Field Strength Meter, Stroboscope, Phase Meter, Vector Impedance Meter, Q Meter, Megger, Analog pH Meter. (Text 1)<br><br>Bridges:Introduction,Wheatstone'sbridge,Kelvin'sBridge;ACbridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell'sbridge,Wien'sbridge,Wagner'searthconnection.(Text 1) | L1, L2,L3 |
| Module -5 | |
| Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers, LVDT, Piezoelectric transducer, Photoelectrictransducer,Photovoltaictransducer,Semiconductorphoto diode and transistor, Temperature transducers-RTD. (Text1) | L1, L2, L3 |
| CourseOutcomes:Afterstudyingthiscourse,studentswillbeableto:<br>• Solve problems related to accuracy and precision.<br>• Identify the functioning of various types of analog and digital measuring instruments.<br>• Identify different types of quantization, resolution and sensitivity in digital instruments,and microprocessor based instrumentation.<br>• Examine the functioning of various types of oscilloscopes and signal generators.<br>• Analyse different types of transducers in various applications. | |

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

TextBooks:


1. H.S. Kalsi, "ElectronicInstrumentation",McGraw Hill,3rdEdition,2012,ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2ndEdition, 2006, ISBN81-203-2360-2.


Reference Books:


1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1stEdition,2015,ISBN:9789332556065.
2. A.K.Sawhney,"ElectronicsandElectricalMeasurements",DhanpatRai&Sons. ISBN -81-7700-016-0


Web Link and Video Lectures:

1. https://swayam.gov.in/nd1_noc19_ee44/preview
2. https://ekeeda.com/subject/electronic-instrumentation-and-measurement

ENGINEERING ELECTROMAGNETICS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| Subject Code | 15EC36 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours per Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- Study the different coordinate systems, Physical signifiance of Divergence, Curl andGradient.
- UnderstandtheapplicationsofCoulomb'slawandGausslawtodifferentcharge distributions and the applications of Laplace's and Poisson's Equations to solve realtimeproblemsoncapacitanceofdifferentchargedistributions.
- UnderstandthephysicalsignificanceofBiot-Savart's,Amperes'sLawandStokes' theorem for different currentdistributions.
- Infer the effects of magnetic forces, materials andinductance.
- KnowthephysicalinterpretationofMaxwell'equationsandapplicationsforPlane waves for their behaviour in differentmedia
- AcquireknowledgeofPoyntingtheoremanditsapplicationofpowerflow.

| Modules | RBT Level |
|---|---|
| Module - 1 | |
| Coulomb's Law, Electric Field Intensity and Flux density Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density. | L1, L2, L3 |
| Module -2 | |
| Gauss's law and Divergence<br>Gauss'law,Divergence.Maxwell'sFirstequation(Electrostatics), Vector Operator ▼ and divergencetheorem.<br><br>Energy, Potential and Conductors<br>Energyexpendedinmovingapointchargeinanelectricfield,The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity ofcurrent. | L1, L2, L3 |
| Module -3 | |
| Poisson's and Laplace's Equations<br>DerivationofPoisson'sandLaplace'sEquations,Uniqueness theorem, Examples of the solution of Laplace's equation. Steady MagneticField<br>Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, MagneticfluxandmagneticfluxdensityScalarandVectorMagnetic Potentials. | L1, L2, L3 |
| Module -4 | |

| | |
|---|---|
| Magnetic Forces<br>Forceonamovingcharge,differentialcurrentelements,Force between differential currentelements.<br><br>Magnetic Materials<br>Magnetisation and permeability, Magnetic boundary conditions, Magneticcircuit,PotentialEnergyandforcesonmagneticmaterials. | L1, L2, L3 |
| Module -5 | |
| Time-varying fields and Maxwell'sequations<br>Farday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.<br><br>Uniform Plane Wave<br>Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect. | L1, L2, L3 |

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

- Interpret the problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
- Analyze potential and energy with respect to point charge and capacitance using Laplace equation.
- Solve for magnetic field, force, and potential energy of magnetic materials.
- Apply Maxwell's equation for time varying fields, EM waves in free space and conductors.
- Make use of Poyntingtheorem to find power associated with EM waves.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consisting of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Book :

W.H.HaytandJ.A.Buck,"EngineeringElectromagnetics",7thEdition,Tata McGraw-Hill, 2009,ISBN-978-0-07-061223-5.

ReferenceBooks:

1. JohnKraussandDanielAFleisch,"Electromagneticswithapplications",McGraw- Hill.
2. N.NarayanaRao,"FundamentalsofElectromagneticsforEngineering",Pearson.

Web Link and Video Lectures:

1. https://www.coursera.org/lecture/electrodynamics-introduction/1-1-introduction-to-electromagnetism-qiIQb
2. https://www.classcentral.com/course/swayam-electromagnetic-theory

ANALOG ELECTRONICS LABORATORY

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

SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| LaboratoryCode | 15ECL37 | IA Marks | 20 |
| Number of Lecture Hours/Week | 01Hr Tutorial (Instructions) + 02 Hours Laboratory | Exam Marks | 80 |
| RBT Level | L1, L2, L3 | Exam Hours | 03 |

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluationof:

- Rectifiers and VoltageRegulators.
- BJT characteristics andAmplifiers.
- JFET Characteristics andAmplifiers.
- MOSFET Characteristics andAmplifiers
- Power Amplifiers.
- RC-Phase shift, Hartley, Colpitts and CrystalOscillators.

NOTE: The experiments are to be carried using discrete components only.

Laboratory Experiments:

1. Designandsetupthefollowingrectifierswithandwithoutfiltersandtodetermine ripple factor and rectifierefficiency:
   (a) FullWaveRectifier (b) BridgeRectifier

2.Conductexperimenttotestdiodeclipping(single/doubleended)andclamping circuits(positive/negative).

3.ConductanexperimentonSeriesVoltageRegulatorusingZenerdiodeandpower transistor to determine line and load regulationcharacteristics.

4.RealizeBJTDarlingtonEmitterfollowerwithandwithoutbootstrappingand determine the gain, input and outputimpedances.

5.DesignandsetuptheBJTcommonemitteramplifierusingvoltagedividerbiaswith and without feedback and determine the gain- bandwidth product from its frequencyresponse.

6.Plotthetransferanddraincharacteristicsofa JFETandcalculateitsdrain resistance, mutual conductance and amplificationfactor.

7.Design,setupandplotthefrequencyresponseofCommonSourceJFET/MOSFET amplifier and obtain thebandwidth.

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters,namely;drainresistance,mutualconductanceandamplificationfactor.

9.Set-upandstudytheworkingofcomplementarysymmetryclass Bpushpullpower amplifier and calculate theefficiency.

10.Designandset-uptheRC-PhaseshiftOscillatorusingFET,andcalculatethe frequency of outputwaveform.

11.Designandset-upthefollowingtunedoscillatorcircuitsusingBJT,anddetermine the frequency ofoscillation.
(a) Hartley Oscillator (b) Colpitts Oscillator

12.Designandset-upthecrystaloscillatoranddeterminethefrequencyofoscillation.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

- Construct the circuits to identify the working of rectifiers, clipping circuits, clamping circuits and voltage regulators.
- Identify the characteristics of BJT and FET amplifiers and plot its frequency response.
- Identify the performance parameters of amplifiers and voltage regulators.
- Construct the BJT Power amplifier to calculate its efficiency
- Examine the performance characteristics of oscillators.

Conduct of Practical Examination:

- Alllaboratoryexperimentsaretobeincludedforpracticalexamination.
- Students are allowed to pick one experiment from thelot.
- Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscriptfor breakup ofmarks.
- ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.

DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III (EC/TC)

| | | | |
|---|---|---|---|
| Laboratory Code | 15ECL38 | IA Marks | 20 |
| Number of Lecture Hours/Week | 01Hr Tutorial (Instructions)<br>+ 02 Hours Laboratory | Exam Mark | 80 |
| RBT Level | L1, L2, L3 | Exam Hour | 03 |

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience in design, realisation and verificationof

- Demorgan's Theorem, SOP, POSforms
- Full/Parallel Adders, Subtractors and MagnitudeComparator
- Multiplexer using logicgates
- Demultiplexers andDecoders
- Flip-Flops, Shift registers andCounters

NOTE:

1. Usediscretecomponentstotestandverifythelogicgates.TheICumbers given are suggestive. Any equivalent IC can beused.
2. ForexperimentNo.11and12anyopensourceorlicensedsimulationtool may beused.

Laboratory Experiments:

1. Verify
   (a) Demorgan's Theorem for 2variables.
   (b) Thesum-ofproductandproduct-of-sumexpressionsusinguniversal gates.
2. Design andimplement
   (a) Full Adder using basic logicgates.
   (b) Full subtractor using basic logicgates.
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
5. Realize
   (a) 4:1 Multiplexer usinggates.
   (b) 3-variable function using IC74151(8:1MUX).
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.
7. Realize the following flip-flops using NANDGates.
   (a) ClockedSRFlip-Flop (b) JKFlip-Flop.
8. Realize the following shift registers usingIC7474
   (a) SISO (b) SIPO (c) PISO (d)PIPO.
9. Realize the Ring Counter and Johnson Counter using IC7476.
10. Realize the Mod-N Counter using IC7490.

| |
|---|
| 11. Simulate Full- Adder using simulation tool. |
| 12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool. |
| Course outcomes: On the completion of this laboratory course, the students will be able to:<br>• Identify the truth table of various expressions and combinational circuits using logic gates.<br>• Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers.<br>• Develop Boolean expressions using decoders.<br>• Construct flips-flops, counters and shift registers<br>• Construct full adder and up/down counters |
| Conduct of Practical Examination:<br>• Alllaboratoryexperimentsaretobeincludedforpractical examination.<br>• Studentsareallowedtopickoneexperimentfromthelot.<br>• Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscriptfor breakup ofmarks.<br>• Changeofexperimentisallowedonlyonceand15%Marksallottedtothe procedure part to be madezero. |

## MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

B.E., V Semester, EC/TC/EI/BM/ML
[As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| Subject Code | 15ES51 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |
| CREDITS – 04 | | | |

Course Objectives: This course will enable students to:

- Understand basic skills ofManagement
- Understand the need for Entrepreneurs and theirskills
- Understand Project identification andSelection
- Identify the Management functions and Socialresponsibilities
- Distinguish between management andadministration

| Module-1 | RBT Level |
|---|---|
| Management:NatureandFunctionsofManagement–Importance,Definition, ManagementFunctions,LevelsofManagement,RolesofManager,Managerial Skills, Management & Administration, Management as a Science, Art& Profession (Selected topics of Chapter 1, Text1).<br><br>Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making(Selected topics from Chapters 4 & 5, Text 1). | L1, L2 |
| Module-2 | |
| Organizing and Staffing: Organization -Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees– Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11,Text 1).<br><br>Directing and Controlling:Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process<br>(Selected topics from Chapters 15 to 18 and 9, Text1). | L1, L2 |
| Module-3 | |
| Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business<br>Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1). | L1, L2 |

| | |
|---|---|
| Entrepreneurship : Definition of Entrepreneur, Importance of Entrepreneurship,conceptsofEntrepreneurship,Characteristicsofsuccessful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building forEntrepreneurship<br>(Selected topics from Chapter 2, Text 2). | |
| Module-4 | |
| Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India,GrowthandPerformanceofSmallScaleIndustriesinIndia,Sicknessin SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry(Definitiononly)(SelectedtopicsfromChapter1,Text2).<br>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics<br>from Chapter 4, Text 2). | L1, L2 |
| Module-5 | |
| Projects Management :AProject. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.<br>Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.<br>(Selected topics from Chapters 16 to 20 of Unit 3, Text 3). | L1, L2, L3 |

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

- Identify the different fundamental concepts of Management and Entrepreneurship.
- Select the best Entrepreneurship model for the required domain of establishment.
- Explain the functions of Managers, Entrepreneurs and their social responsibilities.
- Survey the Institutional support by various state and central government agencies
- Apply the knowledge of Project Formulation and Evaluation Techniques.

Question paper pattern

- The question paper will have TENquestions.
- Each full question carries 16marks.
- Therewillbetwofullquestions(withamaximumofThreesubquestions)from eachmodule.
- Eachfullquestionwillhavesubquestionscoveringalltopicsunderamodule.
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017.ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN:978-81-8488-801-2.

Reference Book:

Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

Web Link and Video Lectures:

1. https://www.edx.org/learn/entrepreneurship
2. https://www.startupindia.gov.in/content/sih/en/reources/l-d-listing.html

DIGITAL SIGNAL PROCESSING

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC52 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of LectureHours | 50 (10 Hours / Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to

- Understandthefrequencydomainsamplingandreconstructionofdiscretetime signals.
- Studythepropertiesandthedevelopmentofefficientalgorithmsforthecomputation of DFT.
- Realization of FIR and IIR filters in different structuralforms.
- LearntheproceduresdesignofIIRfiltersfromtheanalogfiltersusingimpulse invariance and bilineartransformation.
- StudythedifferentwindowsusedinthedesignofFIRfiltersanddesignappropriate filters based on thespecifications.

Modules

| Module-1 | RBT Level |
|---|---|
| Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution. | L1, L2 |
| Module-2 | |
| Additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). | L1, L2, L3 |
| Module-3 | |
| Radix-2FFTalgorithmforthecomputationof DFTandIDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform. | L1, L 2, L3 |
| Module-4 | |
| Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation. | L1, L 2, L3 |
| Module-5 | |
| StructureforFIRSystems:Directform,LinearPhase,Frequencysampling | L1,L2, |

| | |
|---|---|
| structure, Lattice structure.<br>FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows. | L3 |

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

- Construct the frequency domain sampling and reconstruction of discrete time signals.
- Make use of the properties and develop efficient algorithms for the computation of DFT.
- Construct FIR and IIR filters in different structural forms.
- Utilize the procedures to design IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Identify the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

Question paper pattern:

- The question paper will have tenquestions
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule
- The students will have to answer 5 full questions, selecting one full question from eachmodule.

Text Book:

Digital signal processing – Principles Algorithms &Applications ,Proakis&Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

Reference Books:

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI,2003.
2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition,2010.
3. Digital Signal Processing, Lee Tan: Elsevier publications,2007.

Web Link and Video Lectures:

1. https://www.classcentral.com/course/dsp
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

Verilog HDL

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC53 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- Differentiate between Verilog and VHDLdescriptions.
- Learn different Verilog HDL and VHDLconstructs.
- Familiarize the different levels of abstraction inVerilog.
- UnderstandVerilogTasksandDirectives.
- UnderstandtiminganddelaySimulation.
- LearnVHDLatdesignlevelsofdataflow,behavioralandstructuralforeffective modeling of digitalcircuits.

| Module-1 | RBT Level |
|---|---|
| Overview of Digital Design with VerilogHDL<br>EvolutionofCAD,emergenceofHDLs,typicalHDL-flow,whyVerilog HDL?, trends in HDLs.(Text1)<br>Hierarchical Modeling Concepts<br>Top-downandbottom-updesignmethodology,differencesbetween modulesandmoduleinstances,partsofasimulation,designblock, stimulus block.(Text1) | L1, L2, L3 |
| Module-2 | |
| Basic Concepts<br>Lexical conventions, data types, system tasks, compiler directives. (Text1)<br>Modules andPorts<br>Module definition, port declaration, connecting ports, hierarchical name referencing.(Text1) | L1, L2, L3 |
| Module-3 | |
| Gate-Level Modeling<br>Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)<br>Dataflow Modeling<br>Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1) | L1, L2, L3 |
| Module-4 | |
| Behavioral Modeling<br>Structured procedures, initial and always, blocking and non-blocking | L1, L2, L3 |

| | |
|---|---|
| statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.<br>(Text1) | |
| Module-5 | |
| Introduction to VHDL<br>Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis, Design tool flow, Font conventions.<br>Entities and Architectures: Introduction, A simple design, Design entities, Identifiers, Data objects, Data types, and Attributes. (Text 2) | L1, L2, L3 |

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

- Develop Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction & simple programs in VHDL in different styles.
- Identify the suitable Abstraction level for a particular digital design. •
- Develop the programs more effectively using Verilog tasks and directives.
- Develop verilog code for timing and delay Simulation
- Develop and verify the functionality of digital circuit/system using test benches.usingvhdl and verilog

Question paper pattern:

- The question paper will have tenquestions
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)from eachmodule.
- EachfullquestionwillhavesubquestionscoveringallthetopicsundEra module
- The students will have to answer 5 full questions, selecting one full question from eachmodule

Text Books:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Designand Synthesis" , Pearson Education, SecondEdition.
2. Kevin Skahill, "VHDL for Programmable Logic ", PHI/Pearson education,2006.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifthedition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Secondedition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 orearlier.

Web Link and Video Lectures:

1. https://www.coursera.org/courses?query=verilog

INFORMATION THEORY AND CODING

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC54 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |
| CREDITS – 04 | | | |

Course Objectives: This course will enable students to:

- UnderstandtheconceptofEntropy,Rateofinformationandorderofthesource with reference to dependent and independentsource.
- Study various source encodingalgorithms.
- Model discrete & continuous communicationchannels.
- Study various error control codingalgorithms.

Modules

| Module-1 | RBT Level |
|---|---|
| Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources (Section 4.1, 4.2 ofText 1). | L1, L2, L3 |
| Module-2 | |
| Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2).<br>Encoding of the Source Output, Shannon's Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1).<br>Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm (Sections 3.6, 3.7, 3.8, 3.10 of Text 3). | L1, L2, L3 |
| Module-3 | |
| InformationChannels:CommunicationChannels(Section4.4ofText1). Channel Models, Channel Matrix, Joint probabilty Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections4.2, 4.3, 4.4, 4.6, 4.7 of Text 3). | L1, L2, L3 |
| Module-4 | |

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|---|---|
| Error Control Coding :<br>Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.<br>Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction<br>(Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1). | L1, L2, L3 |
| Module<br>-5 | |
| Some Important Cyclic Codes: Golay Codes, BCH Codes( Section 8.4 – Article 5 of Text 2).<br>Convolution Codes : Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The ViterbiAlgorithm)(Section8.5–Articles1,2and3,8.6-Article1ofText2). | L1, L2, L3 |

Course Outcomes: At the end of the course the students will be ableto:

- Make use of the concepts of dependent & independent source to measure the information, entropy, rate of information and order of a source.
- Construct the information codes using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms.
- Model the continuous and discrete communication channels using input, output and joint probabilities.
- Develop a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolution codes
- Examine the encoding and decoding circuits for Linear Block codes, cyclic codes, convolution codes, BCH and Golay codes.

Question paper pattern:

- The question paper will have tenquestions
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)from eachmodule.
- EachfullquestionwillhavesubquestionscoveringallthetopicsundersA module
- The students will have to answer 5 full questions, selecting one full question from eachmodule

Text Books:

1. Digitalandanalogcommunicationsystems,K.SamShanmugam,JohnWiley India Pvt. Ltd,1996.
2. Digitalcommunication,SimonHaykin,JohnWileyIndiaPvt.Ltd,2008.
3. InformationTheoryandCoding,MuralidharKulkarni,K.S.Shivaprakasha,Wiley India Pvt. Ltd, 2015,ISBN:978-81-265-5305-1.

Reference Books:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition,2007
2. Principlesofdigitalcommunication,J.Das,S.K.Mullick,P.K.Chatterjee, Wiley, 1986 - Technology &Engineering

3. DigitalCommunications–FundamentalsandApplications,BernardSklar, SecondEdition,PearsonEducation,2016,ISBN:9780134724058.
4. InformationTheoryandCoding,K.N.Haribhat,D.GaneshRao,Cengage Learning, 2017.

Web Link and Video Lectures:

1. https://www.coursera.org/learn/information-theory
2. https://www.classcentral.com/course/informationtheory

NANOELECTRONICS

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC551 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of LectureHours | 40 (8 Hours /Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course Objectives: This course will enable students to:

- Enhancebasicengineeringscienceandtechnicalknowledgeof nanoelectronics.
- Explainbasicsoftop-downandbottom-upfabricationprocess,devicesand systems.
- Describe technologies involved in modern day electronicdevices.
- Knowvariousnanostructuresofcarbonandthenatureofthecarbonbonditself.
- Learnthephotophysicalpropertiesofsensorusedingeneratingasignal.

| Module-1 | RBT Level |
|---|---|
| Introduction: Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giantmolecularsolids,Freeelectronmodelsandenergybands,crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometerlengthscale,Fabricationmethods:Topdownprocesses,Bottom upprocessesmethodsfortemplatingthegrowthofnanomaterials,ordering ofnanosystems (Text 1). | L1, L2 |
| Module-2 | |
| Characterization: Classification, Microscopic techniques, Field ion microscopy,scanningprobetechniques,diffractiontechniques:bulkand surface diffraction techniques (Text1).<br>Inorganic semiconductor nanostructures: overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states (Text 1). | L1, L2 |
| Module-3 | |
| Fabrication techniques: requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostaticallyinduceddotsandwires,Quantumwellwidthfluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques.(Text1).<br>Physical processes: modulation doping, quantum hall effect, resonant tunneling, charging effects, ballistic carrier transport, Inter band absorption, intraband absorption, Light emission processes, phonon bottleneck,quantumconfinedstarkeffect,nonlineareffects,coherence and dephasing, characterization of semiconductor nanostructures:optical | L1, L2 |

| | |
|---|---|
| electrical and structural (Text 1). | |
| Module-4 | |
| Carbon Nanostructures: Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes. (Text 2) | L1, L2 |
| Module-5 | |
| Nanosensors: Introduction, What is Sensor and Nanosensors?, What makes them Possible?, Order From Chaos, Characterization, Perception, Nanosensors Based On Quantum Size Effects, Electrochemical Sensors, SensorsBasedOnPhysicalProperties,Nanobiosensors,SmartdustSensor for the future. (Text3)<br>Applications: Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures, QWIP's, NEMS, MEMS (Text 1). | L1, L2 |
| Course outcomes: After studying this course, students will be able to:<br>• KnowtheprinciplesbehindNanoscienceengineeringand Nanoelectronics.<br>• Knowtheeffectofparticlessizeonmechanical,thermal,opticaland electrical properties ofnanomaterials.<br>• Knowthepropertiesofcarbonandcarbonnanotubesandits applications.<br>• Knowthepropertiesusedforsensingandtheuseofsmartdust sensors.<br>• Applytheknowledgetoprepareandcharacterizenanomaterials.<br>• Analysetheprocessflowrequiredtofabricatestate-of-the-art transistortechnology. | |
| Question paper pattern:<br>• The question paper will have tenquestions<br>• Each full question consists of 16marks.<br>• Therewillbe2fullquestions(withamaximumofthreesubquestions)from eachmodule.<br>• Eachfullquestionwillhavesubquestionscoveringallthetopicsundera module<br>• The students will have to answer 5 full questions, selecting one full question from eachmodule | |
| Text Books:<br>1. EdRobertKelsall,IanHamley,MarkGeoghegan,"NanoscaleScienceand Technology", John Wiley,2007.<br>2. CharlesPPoole,Jr,FrankJOwens,"IntroductiontoNanotechnology", John Wiley, Copyright 2006, Reprint2011.<br>3. TPradeep,"Nano:Theessentials-UnderstandingNanoscienceand Nanotechnology",TMH. | |
| Reference Book:<br>EdWilliamAGoddardIII,DonaldWBrenner,SergeyE.Lyshevski,GeraldJ Iafrate,"HandBookofNanoscienceEngineeringandTechnology",CRCpress, 2003. | |

SWITCHING & FINITE AUTOMATA THEORY

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC552 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course Objectives: This course will enable students to:

1. Understandthebasicsofthresholdlogic,effectofhazardsondigitalcircuitsand techniques of faultdetection
2. Explain finite state model and minimizationtechniques
3. Know structure of sequential machines, and stateidentification
4. Understand the concept of fault detectionexperiments

Modules

| Module-1 | RBT Level |
|---|---|
| Threshold Logic : Introductory Concepts: Threshold element, capabilities and limitations of threshold logic, Elementary Properties, Synthesis of Threshold networks: Unate functions, Identification and realization of thresholdfunctions,Themapasatoolinsynthesizingthresholdnetworks. (Sections 7.1, 7.2 of Text) | L1, L2, L3 |
| Module-2 | |
| Reliable Design and Fault Diagnosis : Hazards, static hazards, Design of Hazard-free Switching Circuits, Fault detection in combinational circuits, Fault detection in combinational circuits: The faults, The Fault Table, Covering the fault table, Fault location experiments: Preset experiments, Adaptive experiments, Boolean differences, Fault detection by path sensitizing. (Sections 8.1, 8.2, 8.3, 8.4, 8.5 of Text) | L1, L2, L3 |
| Module-3 | |
| Sequential Machines: Capabilities, Minimization and Transformation The Finite state model and definitions, capabilities and limitations of finite state machines, State equivalence and machine minimization: k- equivalence, The minimization Procedure, Machine equivalence, Simplificationofincompletelyspecifiedmachines.(Section10.1,10.2,10.3, 10.4 of Text) | L1, L2, L3 |
| Module-4 | |
| Structureof Sequential Machines: Introductory example, State assignment using partitions: closed partitions, The lattice of closed partitions, Reduction of output dependency, Input dependence and autonomous clocks, Covers and generation of closed partitions by state splitting: Covers, The implication graph, An application of state splittingto parallel decomposition. (Section 12.1, 12.2, 12.3, 12.4, 12.5, 12.6 of Text) | L1, L2, L3 |
| Module-5 | |
| State–Identification and Fault Detection Experiments: Experiments, Homing experiments, Distinguishing experiments, Machine identification, | L1, L2, L3 |

| | |
|---|---|
| Fault detection experiments, Design of diagnosable machines, Second algorithmforthedesignoffaultdetectionexperiments.(Sections13.1,13.2, 13.3, 13.4, 13.5, 13.6, 13.7 of Text) | |

Course outcomes: At the end of the course, students should be ableto:

- Explain the concept of thresholdlogic
- Understand the effect of hazards on digital circuits and fault detection and analysis
- Define the concepts of finite statemodel
- Analyze the structure of sequentialmachine
- Explainmethodsofstateidentificationandfaultdetectionexperiments

Question paper pattern:

- The question paper will have tenquestions
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)from eachmodule.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsundera module
- The students will have to answer 5 full questions, selecting one full question from eachmodule

Text Book:

Switching and Finite Automata Theory – ZviKohavi, McGraw Hill, 2nd edition, 2010 ISBN: 0070993874.

Reference Books:

1. Fault Tolerant AndFault Testable Hardware Design -Parag K Lala, Prentice Hall Inc.1985.
2. DigitalCircuitsandLogicDesign.-CharlesRothJr,LarryL.Kinney,Cengage Learning, 2014, ISBN: 978-1-133-62847-7.

OPERATING SYSTEM

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC553 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of LectureHours | 40 (8 Hours /Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course objectives: This course will enable students to:

- Understand the services provided by an operatingsystem.
- Understand how processes are synchronized andscheduled.
- Understanddifferentapproachesofmemorymanagementandvirtualmemory management.
- Understand the structure and organization of the filesystem
- Understand interprocess communication and deadlocksituations.

| Module-1 | RBT Level |
|---|---|
| Introduction to Operating Systems<br>OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming,TimeSharingSystems,RealTimeanddistributedOperating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 ofText). | L1, L2 |
| Module-2 | |
| Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2 , 4.2, 4.3, 4.4.1<br>of Text). | L1, L2 |
| Module-3 | |
| Memory Management: Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM<br>handler,FIFO,LRUpagereplacementpolicies(TopicsfromSections5.5to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1ofText). | L1, L2 |
| Module-4 | |
| File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from<br>Sections 7.1 to 7.8 of Text). | L1, L2, L3 |
| Module-5 | |
| Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Resource state modelling, Deadlock detection<br>algorithm,DeadlockPrevention(TopicsfromSections10.1to10.3,11.1to | L1, L2, L3 |

| | |
|---|---|
| 11.5 of Text). | |

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

- Identify the goals, structure, operation and types of operating systems.
- Utilize process management & scheduling techniques to find performance factors.
- Make use of suitable techniques for contiguous and non-contiguous memory allocation.
- Identify various types of organization of file systems and IOCS.
- Identify various message passing, deadlock detection and prevention methods.

Question paper pattern:

- The question paper will have tenquestions
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule

Text Book:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:


1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operatingsystem–internalsanddesignsystem,WilliamStalling,Pearson Education, 4th ed,2006.
3. Design of operating systems, Tannanbhaum, TMH,2001.

ELECTRICAL ENGINEERING MATERIALS

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

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

| Subject Code | 15EC554 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8Hours/Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to:

- Understandtheformationofbandsinmaterialsandtheclassificationofmaterials on the basis of bandtheory
- Understandtheclassificationofmagneticmaterialsonthebasisoftheirbehaviorin an external magnetizingfield.
- Understandthecharacteristicsandpropertiesofconductingandsuperconducting materials
- Understandtheelectricalcharacteristicsofthematerialtobeconsideredonthe basis of theiruses.
- Classifyelectricalengineeringmaterialsintolowandhighresistancematerials

Modules

| Module-1 | RBT Level |
|---|---|
| Band Theory of Solids: Introduction to free electron theory, Kroning- Penney Model, Explanation for Discontinuities in E vs. K curve, Formation of Solid Material, Formation of Band in Metals, Formation of Bands in SemiconductorsandInsulatingMaterials,ClassificationofMaterialsonthe Basis of Band Structure, Explanation for differences in the Electrical properties of different Materials. Important Characteristics of a Band Electron,Numberofenergystatesperband,ExplanationforInsulatingand Metallic Behavior of Materials, Concept ofHole. | L1, L2 |
| Module-2 | |
| Magnetic Properties of Materials: Introduction, Origin of Magnetism, Basic Terms in Magnetism, Relation between Magnetic Permeability and Susceptibility, Classification of magnetic Materials, Characteristics of Diamagnetic Materials, Paramagnetic Materials, Ferromagnetic Materials, FerrimagneticMaterials,Langevin'sTheoryofDiamagnetism,Explanationof Dia, Para and Ferromagnetism, Ampere's Lam in Dia, Para and Ferromagnetism, Hystersis and Hystersis loss, Langevin's Theory of paramagnetism, Modification in the Langevin's Theory, Anti-FerromagnetismandNeelTemperature,FerrimagneticMaterials,Properties of some important Magnetic Materials, Magentostriction and MagnetostrictiveMaterials,HardandSoftFerromagneticMaterialsandtheir Applications. | L1, L2 |
| Module-3 | |
| Behavior of Dielectric Materials in ACand DC Fields: Introduction, Classification of Dielectric Materials at Microscopic level, Polar Dielectric Materials,Non-polarDielectricMaterials,KindsofPolarizations,behaviorof | L1, L2 |

| | |
|---|---|
| dielectric materials, Three electric Vectors, Gauss's Law in a Dielectric, Electric Susceptibility and Static Dielectric constant, Effect of Dielectric medium upon capacitance, macroscopic electric field, Microscopic Electric field, temperature dependence of dielectric constant, polar dielectric in ac and dc fields, behavior of polar dielectric at high frequencies, Dielectric loss, Dielectric strength and Dielectric Breakdown, Various kinds of Dielectric Materials, Hysteresis in Ferroelectric Materials, Applications of Ferroelectric Materials in Devices. | |
| Module-4 | |
| Conductivity of Metals and Superconductivity: Introduction, Ohm's law, Explanation for the dependence of electrical resistivity upon temperature, Free-electron theory of metals, Application of Lorentz-Drude free-electron theory, Effect of various parameters on Electrical Conductivity, Resistivity Ratio, Variation of resistivity of alloys with temperature, Thermal Conductivity of Materials, Heat produced in Current Carrying Conductor, Thermoelectric Effect, Thermoelectric Series, Seebeck's Experiment.<br><br>Discovery of superconductivity, superconductivity and transition temperature, superconducting materials, explanation of superconductivity phenomenon,characteristicsofsuperconductors,changeinthermodynamic parameters in superconducting state, frequency dependenceof superconductivity, current status of high temperature superconductors, practical applications of superconductors. | L1, L2 |
| Module-5 | |
| Electrical Conducting and Insulating materials: Introduction, Classification of conducting materials, difference in properties of Hard- Drawn and Annealed copper, standard conductors, comparison between some popular Low-Resistivity Materials, Low-Resistivity Copper Alloys, Electrical contact materials and their selection, classification of contact materials, Materials for Lamp Filaments, Preparation of Tungsten Filaments.<br><br>Insulating gases, Liquids and solids and their characteristics, Selection of the insulating material, other important properties of Insulating materials, Thermal characteristics, chemical properties of Insulating materials, classification of Insulating materials on the basis ofstructure. | L1, L2 |

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

- Understandthevariouskindsofmaterialsandtheirapplicationsinacanddc fields.
- Understand the conductivity of superconductivity ofmaterials.
- Explaintheelectricalpropertiesofdifferentmaterialsandmetallicbehaviorof materials on the basis of bandtheory.
- Explainthepropertiesandapplicationsofallkindofmagneticmaterials.
- Explainthepropertiesofelectricalconductingandinsulatingmaterials.
- Assessavarietyofapproachesindevelopingnewmaterialswithenhanced performance to replace existingmaterials.

Question paper pattern:

- The question paper will have tenquestions

- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofthreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule

Text Book:

RKShuklaandArchanaSingh,"ElectricalEngineeringMaterials"McGrawHill, 2012, ISBN:978-1-25-90062-03.

Reference Books:

1. S.O.KASAP,"ElectronicMaterialsandDevices"3rdedition,McGrawHill,2014, ISBN-978-0-07-064820-3.
2. C.S.IndulkarandS.Thiruvengadam,S.,"AnIntroductiontoElectrical Engineering Materials", ISBN-9788121906661.

MSP430 MICROCONTROLLER

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC555 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours / Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course objectives: This course will enable students to:

- Understandthearchitecturalfeaturesandinstructionsetof16bitmicrocontroller MSP430.
- ProgramMSP430usingthevariousinstructionsfordifferentapplications.
- Understandthefunctionsofthevariousperipheralswhichareinterfacedwith MSP430.
- Describe the power saving modes inMSP430.
- Explain the low power applications usingMSP430.

| Module-1 | RBT Level |
|---|---|
| MSP430 Architecture : Introduction –Where does the MSP430 fit, The outsideview,Theinsideview-Functionalblockdiagram,Memory,Central Processing Unit, Memory Mapped Input and Output, Clock Generator, Exceptions: Interrupts and Resets, MSP430family. (Text: Ch1- 1.3 to 1.7, Ch2- 2.1 to 2.7, Ch5- 5.1, 5.7 up to 5.7.1) | L1, L2 |
| Module-2 | |
| Addressing Modes &Instruction Set-Addressing Modes, Instruction set, Constant Generator and Emulated Instructions, Program Examples. (Text: Ch5- 5.2 to5.5) | L1, L2, L3 |
| Module-3 | |
| Clock System, Interrupts and Operating Modes-Clock System, Interrupts, What happens when an interrupted is requested, Interrupt ServiceRoutines,LowPowerModesofOperation,WatchdogTimer,Basic Timer1, Real Time Clock, Timer-A: Timer Block, Capture/Compare Channels, Interrupts fromTimer-A. (Text: Ch5 - 5.8 upto 5.8.4, Ch 6-6.6 to 6.8, 6.10, Ch8 -8.1, 8.2, 8.3) | L1, L2 |
| Module-4 | |
| Analog Input -Output and PWM - Comparator-A, ADC10, ADC12, Sigma- Delta ADC, Internal Operational Amplifiers, DAC, Edge Aligned PWM, Simple PWM, Design of PWM. LCD interfacing. (Text: Ch9 – 9.1 up to 9.1.2, 9.4, 9.5 up to 9.5.1, 9.7, 9.8 up to 9.8.1, 9.11.5, 9.12 (without 9.12.1), 8.6.2 to 8.6.4) | L1, L2 |
| Module-5 | |

| | |
|---|---|
| Digital Input-Output and SerialCommunication:<br>ParallelPorts,LightingLEDs,FlashingLEDs,ReadInputfromaSwitch,<br>TogglетheLEDstatebypressingthepushbutton,LCDinterfacing.<br>AsynchronousSerialCommunication,AsynchronousCommunicationwith USCI_A,<br>Communications, Peripherals in MSP430, Serial Peripheral Interface.<br>(Text: Selected topics from Ch4 & Ch7 and Ch7- 7.1, Ch10 – 10.1, 10.2,<br>and 10.12) | L1, L2, L3 |
| Course outcomes: After studying this course, students will be able to:<br>• Understandthearchitecturalfeaturesandinstructionsetof16bit microcontrollerMSP430.<br>• DevelopprogramsusingthevariousinstructionsofMSP430for differentapplications.<br>• Understandthefunctionsofthevariousperipheralswhichare interfaced with MSP430microcontroller.<br>• Describe the power saving modes inMSP430.<br>• ExplainthelowpowerapplicationsusingMSP430microcontroller. | |
| Evaluation of Internal AssessmentMarks:<br>It is suggested that at least a few simple programs to be executed by students using any evaluation board of MSP430 for better understanding of the course. This activity canbeconsideredfortheevaluationof5marksoutof20Internalassessmentmarks, reserved for the otheractivities. | |
| Question paper pattern:<br>• The question paper will have tenquestions<br>• Each full question consists of 16marks.<br>• Therewillbe2fullquestions(withamaximumofthreesubquestions)fromeach module.<br>• Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule<br>• Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule | |
| Text Book:<br>JohnHDavies,MSP430MicrocontrollerBasics,NewnesPublications,Elsevier, 2008. | |
| Reference s:<br>1. ChrisNagy,EmbeddedSystemsDesignusingTIMSP430Series,Newnes Publications, Elsevier,2003.<br>2. User Guide from TexasInstruments. | |

DSP Lab

B.E., V Semester, EC/TC

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

| | | | |
|---|---|---|---|
| Subject Code | 15ECL57 | IA Marks | 20 |
| Number of Lecture Hours/Week | 01Hr Tutorial(Instructions)<br>+ 02 Hours Laboratory=03 | Exam Marks | 80 |
| RBT Levels | L1, L2, L3 | Exam Hours | 03 |

CREDITS – 02

Course objectives: This course will enable students to

- Simulatediscretetimesignalsandverificationofsamplingtheorem.
- ComputetheDFTforadiscretesignalandverificationofitspropertiesusing MATLAB.
- Findsolutiontothedifferenceequationsandcomputationofconvolutionand correlation along with the verification ofproperties.
- Computeanddisplaythefilteringoperationsandcomparewiththetheoretical values.
- ImplementtheDSPcomputationsonDSPhardwareandverifytheresult.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent :

1. Verification of samplingtheorem.
2. Linearandcircularconvolutionoftwogivensequences,Commutative, distributive and associative property ofconvolution.
3. Autoandcrosscorrelationoftwosequencesandverificationoftheirproperties
4. Solving a given differenceequation.
5. ComputationofNpointDFTofagivensequenceandtoplotmagnitudeand phasespectrum(usingDFTequationandverifyitbybuilt-inroutine).
6. (i)VerificationofDFTproperties(likeLinearityandParseval'stheorem,etc.)
   (ii) DFT computation of square pulse and Sinc function etc.
7. DesignandimplementationofFIRfiltertomeetgivenspecifications(using different windowtechniques).
8. DesignandimplementationofIIRfiltertomeetgivenspecifications.

Following Experiments to be done using DSP kit

9. Linear convolution of twosequences
10. Circular convolution of twosequences
11. N-point DFT of a givensequence
12. Impulse response of first order and second ordersystem
13. Implementation of FIRfilter

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Apply sampling theorem and effective reconstruction of signal.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Solve difference equations and perform different operations on discrete time signals
- Design IIR and FIR filters for the given specifications.

- Build DSP computations on TMS processor and verify the result

Conduct of PracticalExamination:

1. Alllaboratoryexperimentsaretobeincludedforpracticalexamination.
2. Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscript for breakup ofmarks.
3. ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.

HDL Lab

B.E., V Semester, EC/TC

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

| | | | |
|---|---|---|---|
| Subject Code | 15ECL58 | IA Marks | 20 |
| Number of Lecture Hours/Week | 01Hr Tutorial(Instructions) + 02 Hours Laboratory = 03 | Exam Marks | 80 |
| RBT Levels | L1, L2, L3 | Exam Hours | 03 |

CREDITS – 02

Course objectives: This course will enable students to:

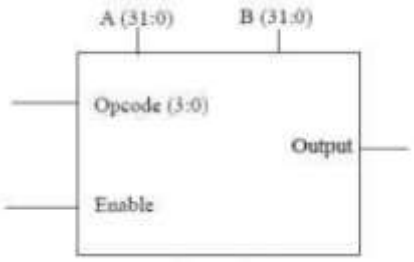
- Familiarize with the CAD tool to write HDLprograms.
- Understand simulation and synthesis of digitaldesign.
- Program FPGAs/CPLDs to synthesise the digitaldesigns.
- InterfacehardwaretoprogrammableICsthroughI/Oports.
- ChooseeitherVerilogorVHDLforagivenAbstractionlevel.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzerapartfromverificationbysimulationwithtoolssuchasAltera/Modelsimor equivalent.

Laboratory Experiments

Part–A: PROGRAMMING

1. Write Verilog code to realize all the logicgates
2. Write a Verilog program for the following combinationaldesigns
    a. 2 to 4decoder
    b. 8 to 3 (encoder without priority & withpriority)
    c. 8 to 1multiplexer.
    d. 4 bit binary to grayconverter
    e. Multiplexer, de-multiplexer,comparator.
3. WriteaVHDLandVerilogcodetodescribethefunctionsofaFullAdderusing three modelingstyles.
4. WriteaVerilogcodetomodel32bitALUusingtheschematicdiagramshown below




- ALU should use combinational logic to calculate an output based on the four bit op-codeinput.
- ALU should pass the result to the out bus when enable line in high, and tri- state the out bus when the enable line islow.

- ALUshoulddecodethe4bitop-codeaccordingtotheexamplegivenbelow.

| OPCODE | ALU Operation |
|---|---|
| 1. | A+B |
| 2. | A-B |
| 3. | A Complement |
| 4. | A*B |
| 5. | A AND B |
| 6. | A OR B |
| 7. | A NAND B |
| 8. | A XOR B |

5. DeveloptheVerilogcodeforthefollowingflip-flops SR,D,JKandT.
6. Designa4bitbinary,BCDcounters(Synchronousresetand Asynchronous reset) and "any sequence" counters, using Verilogcode.

Part–B: INTERFACING (at least four ofthe following must be covered usingVHDL/Verilog)

1. WriteHDLcodetodisplaymessagesonanalphanumericLCDdisplay.
2. Write HDL code to interface Hex key pad and display the key code on seven segmentdisplay.
3. WriteHDLcodetocontrolspeed,directionofDCandSteppermotor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segmentdisplay.
5. WriteHDLcodetogeneratedifferentwaveforms(Sine,Square,Triangle,Ramp etc.,) using DAC - change thefrequency.
6. Write HDL code to simulate Elevatoroperation.

Course Outcomes: At the end of this course, students should be ableto:

- DEVELOP AND Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions
- DEVELOP AND Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms
- DEVELOP AND Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware
- DEVELOP AND Interface the hardware to the programmable chips and obtain the required output
- DEVELOP HARDWARE DESCRIPTIVE PROGRAMMES USING Verilog or VHDL for a given Abstraction level

Conduct of Practical Examination:

1. Alllaboratoryexperimentsaretobeincludedforpracticalexamination.
2. Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscript for breakup ofmarks.
3. ChangeofexperimentisallowedonlyonceandMarksallottedtothe procedure part to be madezero.

5th Semester Open Electives Syllabus for the Courses offered by EC/TC Board

Automotive Electronics
B.E V Semester (Open Elective)
[As per Choice Based Credit System (CBCS) scheme

| | | | |
|---|---|---|---|
| Subject Code | 15EC561 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40(08 Hrs per Module) | Exam Hours | 03 |

CREDITS – 03

Course objectives: This course will enable students to:

- Understandthebasicsofautomobiledynamicsanddesignelectronicsto complement those features.
- Designandimplementtheelectronicsthatattributethereliability,safety,and smartness to the automobiles, providing add-oncomforts.

| Module-1 | RBT Level |
|---|---|
| Automotive Fundamentals Overview – Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, Highvoltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine,DriveTrain-Transmission,DriveShaft,Differential,Suspension, Brakes, Steering System (Text 1: Chapter1), Starter Battery –Operating principle: (Text 2:Pg.407-410) (4hours)<br><br>The Basics of Electronic Engine Control – Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms,Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, sparktimingandEGR onperformance,ControlStrategy,ElectronicFuel controlsystem,Analysisofintakemanifoldpressure,ElectronicIgnition. (Text 1: Chapter 5) (4hours) | L1, L2 |
| Module-2 | |

| | |
|---|---|
| Automotive Control System applications of Sensors and Actuators – TypicalElectronicEngineControlSystem,Variablestobemeasured(Text 1:Chapter6) (1hour)<br>Automotive Sensors – Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor. (Text 1: Chapter 6)<br>(5 hours)<br>Automotive Actuators – Solenoid, Fuel Injector, EGR Actuator, Ignition System (Text 1:Chapter6) (2hours) | L1, L2 |
| Module-3 | |
| Digital Engine ControlSystems – Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme,IntegratedEngineControlSystem-SecondaryAirManagement, Evaporative Emissions Canister Purge, Automatic System Adjustment, SystemDiagnostics.(Text1:Chapter7) (6 hours)<br><br>Control Units – Operating conditions, Design, Data processing, Programming, Digital modules in the Control unit, Control unit software. (Text 2:Pg.196-207) (2hours) | L1, L2 |
| Module-4 | |
| Automotive Networking –Bus Systems – Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles (Text 2: Pg. 85-91), Buses - CAN Bus, LIN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces. (Text 2: Pg. 92-151) (6 hours)<br><br>Vehicle Motion Control – Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS) (Text 1: Chapter 8) (2 hours) | L1, L2 |
| Module-5 | |
| Automotive Diagnostics –Timing Light, Engine Analyzer, On-board diagnostics,Off-boarddiagnostics,ExpertSystems,OccupantProtection Systems– AccelerometerbasedAirBagsystems.(Text1:Chapter10)<br>(2 hours)<br><br>Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, CollisionAvoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation,AutomaticdrivingControl(Text1:Chapter11)<br>(6 hours) | L1, L2, L3 |

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

- Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotiveindustry.
- Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive systemdesign.
- Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the subsystems.
- Design and implement the electronics that attribute the reliability, safety,and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive ElectronicSystems.

Question paper pattern:

- The question paper will have tenquestions.
- Each full Question consisting of 16marks
- There will be 2 full questions (with a maximum of three sub questions) from eachmodule.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from eachmodule.

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.

2. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc.,2007.

Object Oriented Programming UsingC++

B.E. V Semester (Open Elective)

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC562 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (08 Hrs/ Module | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course objectives: This course will enable students to:

- Define Encapsulation, Inheritance andPolymorphism.
- Solve the problem with object orientedapproach.
- Analyzetheproblemstatementandbuildobjectorientedsystemmodel.
- Describe the characters and behavior of the objects that comprise a system.
- Explainfunctionoverloading,operatoroverloadingandvirtualfunctions.
- Discuss the advantages of object oriented programming over procedure orientedprogramming.

| Module -1 | RBT Level |
|---|---|
| Beginning with C++ and itsfeatures:<br>What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from<br>Ch -2,3 of Text). | L1, L2 |
| Module -2 | |
| Functions , classes and Objects:<br>Functions,Inlinefunction,functionoverloading,friendandvirtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions(Selected<br>Topics from Chap-4,5 of Text). | L1, L2, L3 |
| Module -3 | |
| Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operatoroverloading, Overloading Unary and binary operators, Manipulation ofstrings using operators (Selected topics from Chap-6, 7 ofText). | L1, L2, L3 |
| Module -4 | |
| Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure<br>virtual functions (Selected topicsfrom Chap-8,9 of Text). | L1, L2, L3 |
| Module -5 | |

| | |
|---|---|
| Streams and Working with files : C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text). | L1, L2, L3 |

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

- Apply Encapsulation, Inheritance and Polymorphism.
- Utilize Object Oriented approach to solve problems
- Examine problem statements and build object oriented models to solve the problems after analysing the objects that constitute the system.
- Build solutions using function overloading, operator overloading and virtual functions.
- Identify advantages of object oriented programming over procedure oriented programming.

Question paper pattern:

- The question paper will have tenquestions.
- Each full Question consisting of 16marks
- There will be 2 full questions (with a maximum of Three sub questions) from eachmodule.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsundera module.
- Thestudentswillhavetoanswer5fullquestions,selectingonefull question from each module.

Text Book:

Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

Reference Book:

Object Oriented Programming using C++, Robert Lafore, Galgotiapublication2010.

8051 MICROCONTROLLER

B.E., V Semester (Open Elective)

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC563 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (08 Hrs/ Module) | Exam Hours | 03 |

CREDITS – 03

Course objectives: This course will enable students to:

- UnderstandthedifferencebetweenaMicroprocessorandaMicrocontroller and embeddedmicrocontrollers.
- Familiarize the basic architecture of 8051microcontroller.
- Program8051microprocessorusingAssemblyLevelLanguageandC.
- Understandtheinterruptsystemof8051andtheuseofinterrupts.
- UnderstandtheoperationanduseofinbuiltTimers/CountersandSerial port of8051.
- Interface8051toexternalmemoryandI/OdevicesusingitsI/Oports.

| Module -1 | RBT Level |
|---|---|
| 8051 Microcontroller:<br>Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. | L1, L2 |
| Module -2 | |
| 8051Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. | L1, L2 |
| Module -3 | |
| 8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops - Delay subroutine, Factorial of an 8 bit number (result maximum 8 bit), Block move without overlap, Addition of N 8 bit numbers, Picking smallest/largest of N 8 bit numbers.<br>Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. | L1, L2, L3 |
| Module -4 | |
| 8051 Timers and Serial Port: 8051 Timers and Counters – OperationandAssemblylanguageprogrammingtogenerateapulse | L1, L2, L3 |

| | |
|---|---|
| using Mode-1 and a square wave using Mode-2 on a port pin.<br>8051SerialCommunication-BasicsofSerialDataCommunication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive dataserially. | |
| Module -5 | |
| 8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interruptusingaswitch,8051Cprogrammingtogenerateasquare waveform on a port pin using a Timerinterrupt.<br>Interfacing 8051 to ADC-0804, LCD and Stepper motor and their 8051 Assembly language interfacing programming. | L1, L2, L3 |

Evaluation of Internal AssessmentMarks:

It is suggested that at least a few simple programs to be executed by students using a simulation software or an 8051 microcontroller kit for better understandingofthecourse.Thisactivitycanbeconsideredfortheevaluation of 5 marks out of 20 Internal assessment marks, reserved for the other activities.

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

- ExplainthedifferencebetweenMicroprocessors&Microcontrollers, Architectureof8051Microcontroller,Interfacingof8051toexternal memory and Instruction set of8051.
- Write8051Assemblylevelprogramsusing8051instructionset.
- ExplaintheInterruptsystem,operationofTimers/CountersandSerialport of8051.
- Write8051Assemblylanguageprogramtogeneratetimingsandwaveforms using8051timers,tosend&receiveserialdatausing8051serialportand to generate an external interrupt using aswitch.
- Write 8051 C programs to generate square wave on 8051 I/O port pin usinginterruptandtosend&receiveserialdatausing8051serialport.
- Interfacesimpleswitches,simpleLEDs,ADC0804,LCDandStepperMotor to 8051 using 8051 I/Oports.

Question paper pattern:

- The question paper will have tenquestions.
- Each full Question consisting of 16marks
- There will be 2 full questions (with a maximum of Three sub questions) from eachmodule.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsundera module.
- The students will have to answer 5 full questions, selecting one full question from eachmodule.

TEXT BOOKS:

1. " The 8051 Microcontroller and Embedded Systems – using assembly and C ", Muhammad Ali Mazidi and Janice Gillespie Mazidi andRollin D. McKinlay; PHI, 2006 / Pearson, 2006.

2."The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/CengageLearning.

REFERENCE BOOKS:

1. " The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN:978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education,2005.

B.E., VII Semester, Electronics &CommunicationEngineering
[As per Choice Based Credit System (CBCS) scheme]

| Course Code | 15EC71 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of LectureHours | 50 (10 Hours / Module) | Exam Hours | 03 |

CREDITS – 04

Course objectives: This course will enable students to:

- Describe the microwave properties and its transmissionmedia
- Describe microwave devices for severalapplications
- Understand the basics of antennatheory
- Select antennas for specificapplications

Module-1

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2)
Microwave Transmission Lines: Microwave Frequencies, Microwave devices, MicrowaveSystems,TransmissionLineequationsandsolutions,ReflectionCoefficient andTransmissionCoefficient,StandingWaveandStandingWaveRatio,SmithChart, SingleStubmatching.(Text2:0.1,0.2,0.3,3.1,3.2,3.3,3.5,3.6ExceptDoublestub matching) L1,L2

Module-2

Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3)
Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) L1, L2

Module-3

StripLines:Introduction,MicroStriplines,ParallelStriplines,CoplanarStriplines, Shielded Strip Lines. (Text 2: Chapter11)
Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, RadiationIntensity,BeamEfficiency,DirectivityandGain,AntennaApertures,Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15) L1, L2, L3

| Module-4 |
| --- |
| Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem,RadiationIntensity,FieldPatterns,PhasePatterns,ArraysofTwoIsotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.(Text 3: 5.1 – 5.10,5.13)<br>Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of Lambda/2 Antenna. (Text 3: 6.1 -6.6)<br>L1, L2, L3, L4 |
| Module-5 |
| LoopandHornAntenna:Introduction,Smallloop,ComparisonofFarfieldsofSmall LoopandShortDipole,TheLoopAntennaGeneralCase,FarfieldPatternsofCircular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas.(Text 3: 7.1-7.8, 7.19,7.20)<br>AntennaTypes:HelicalAntenna,HelicalGeometry,PracticalDesignConsiderationsof Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) L1, L2,L3 |
| Course Outcomes: At the end of the course, students will be able to:<br>• Identify the working of Reflex Klystron by studying the mode curves and also understand transmission lines structure along with its line equations using smiths charts to calculate the reflection coefficient, SWR, input and load impedance<br>• Solve for Microwave network parameters using S –Matrix also study Passive microwave devices like Connectors, Adapters Attenuators, Tees and phase shifters<br>• Identify the different types of Strip lines and understand the antenna basics to find various parameters like antenna gain, directivity.<br>• Classify the point source Isotropic antenna and Electric dipole<br>• Identify loop, Horn antenna and the Helical antenna by making use of the design considerations |
| Text Books:<br>1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.<br>2. Microwave Devices and circuits - Liao, PearsonEducation.<br>3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan,4thSpecial Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010. |
| Reference Books:<br>1. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.<br>2. Microwave Engineering– Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.<br>3. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press,2007. |

Web Link and Video Lectures:

1. https://www.classcentral.com/course/swayam-microwave-theory-and-techniques-14200
2. https://www.udemy.com/course/rf-microwave-radio-transmission-theory-online-course-rahsoft-rahch200/

DIGITAL IMAGE PROCESSING

B.E., VII Semester, Electronics &CommunicationEngineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC72 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |

CREDITS – 04

Course Objectives: The objectives of this course are to:

- Understand the fundamentals of digital imageprocessing
- Understand the image transform used in digital imageprocessing
- Understandtheimageenhancementtechniquesusedindigitalimageprocessing
- Understand the image restoration techniques and methods used in digital image processing
- UnderstandtheMorphologicalOperationsandSegmentationusedindigitalimage processing

| Module-1 | RBT Level |
|---|---|
| DigitalImageFundamentals:WhatisDigitalImageProcessing?,Origins ofDigitalImageProcessing,ExamplesoffieldsthatuseDIP,Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and NonlinearOperations.<br>[Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2] | L1, L2 |
| Module-2 | |
| Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters<br>FrequencyDomain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.<br>[Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10] | L1, L2, L3 |
| Module-3 | |
| Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear,Position- Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least SquaresFiltering.<br>[Text: Chapter 5: Sections 5.2, to 5.9] | L1, L2, L3 |
| Module-4 | |

| | |
|---|---|
| Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.<br>Wavelets: Background, Multiresolution Expansions.<br>Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.<br>[Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2,<br>Chapter 9: Sections 9.1 to 9.5] | L1, L2, L3 |
| Module-5 | |
| Segmentation: Point, Line, and Edge Detection, Thresholding, Region- Based Segmentation, Segmentation Using Morphological Watersheds.<br>Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1<br>and 11.2] | L1, L2, L3 |

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

- Identify the elements, components, steps, applications, and basic operations in digital image formation and processing.
- Utilize basic mathematical operations for (Gray/Colour) image enhancementin spatial domain
- Model image restoration techniques and make use of morphologicaloperations in image processing
- Examine application of Fourier Transforms and wavelets in imageenhancement and multi-resolution
- Distinguish image analysis techniques for image segmentation,representation and description.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule. Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Book:

Digital Image Processing - Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:

1. DigitalImageProcessing-S.Jayaraman,S.Esakkirajan,T.Veerakumar,Tata McGraw Hill2014.
2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

Web Link and Video Lectures:

1. https://www.coursera.org/courses?languages=en&query=digital%20image%20processing
2. https://www.classcentral.com/course/swayam-digital-image-processing-14005

POWER ELECTRONICS

B.E., VII Semester, Electronics &CommunicationEngineering

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

POWERELECTRONICS

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

| | | | |
|---|---|---|---|
| Course Code | 15EC73 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |

CREDITS – 04

Course Objectives: This course will enable students to:

- Understandtheconstructionandworkingofvariouspowerdevices.
- Studyandanalysisofthyristorcircuitswithdifferenttriggeringconditions.
- Learntheapplicationsofpowerdevicesincontrolledrectifiers,convertersand inverters.
- Studyofpowerelectronicscircuitsundervariousloadconditions.

Module-1

Introduction-ApplicationsofPowerElectronics,PowerSemiconductorDevices,Control CharacteristicsofPowerDevices,typesofPowerElectronicCircuits,PeripheralEffects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output andtransfer
characteristics, di/dt and dv/dt limitations. (Text 1) L1, L2

Module-2

Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transisitor 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, UJT Firing Circuit. (Text 2) L1, L2, L3

Module-3

Controlled Rectifiers - Introduction, Principle of Phase-Controlled ConverterOperation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters,Single-Phase Semi Converter with RL load.
AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle ofPhase Control, Single phase controllers 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, Chopper circuit design. (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, Inverter circuit design.
Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state

relays, Microelectronic relays. (Text 1) L1, L2

Course Outcomes: At the end of the course students should be ableto:

- Identify the basic operation of various power semiconductor devices and their applications.
- Identify the characteristics of SCR and construct commutation and gate triggering circuits for SCR
- Make use of firing circuits model to analyse the AC Voltage controller and rectifier Circuits.
- Analyze applications of Power electronics in Chopper and Static Switching Operation
- Analyze applications of Power electronics for generating PWM in Inverter Circuits.

Evaluation of Internal Assessment Marks:

ItissuggestedthatatleastfourexperimentsofPowerElectronicstobeconductedbythe students. This activity can be considered for the evaluation of 05 marks out of 20 Internal Assessment (IA) Marks, reserved for the otheractivities.

Text Book s:


1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4thEdition, Pearson Education Inc, 2014, ISBN:978-93-325-1844-5.
2. M.DSinghandKBKhanchandani,PowerElectronics,2ndEdition,TataMc-Graw Hill, 2009, ISBN: 0070583897


Reference Books:


1. L.Umanand,PowerElectronics,EssentialsandApplications,JohnWileyIndia Pvt. Ltd,2009.
2. Dr.P.S.Bimbhra,"PowerElectronics",KhannaPublishers,Delhi,2012.
3. P.C.Sen,"ModernPowerElectronics",SChand&CoNewDelhi,2005.
4. EarlGose,RichardJohnsonbaugh,SteveJost,PatternRecognitionandImage Analysis, ePubeBook.


Web Link and Video Lectures:

1. https://www.coursera.org/learn/power-electronics
2. https://swayam.gov.in/nd1_noc19_ee37/preview

MULTIMEDIA COMMUNICATION

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

[As per Choice Based credit System (CBCS) Scheme

| | | | |
|---|---|---|---|
| Subject Code | 15EC741 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of LectureHours | 40 (08 Hours / Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course objectives: This course will enable studentsto:

- Gainfundamentalknowledgeinunderstandingthebasicsofdifferentmultimedia networks andapplications.
- Understanddigitizationprincipletechniquesrequiredtoanalyzedifferentmedia types.
- Analyzecompressiontechniquesrequiredtocompresstextandimageandgain knowledge ofDMS.
- Analyzecompressiontechniquesrequiredtocompressaudioandvideo.
- Gainfundamentalknowledgeaboutmultimediacommunicationacrossdifferent networks.

| Module-1 | RBT Level |
|---|---|
| Multimedia Communications : Introduction, Multimedia information representation,multimedianetworks,multimediaapplications,Application and networking terminology. (Chap 1 of Text1) | L1, L2 |
| Module-2 | |
| Information Representation : Introduction, Digitization principles, Text, Images, Audio and Video (Chap 2 of Text 1) | L1, L2 |
| Module-3 | |
| Text and image compression: Introduction, Compression principles, text compression, image Compression. (Chap 3 of Text 1)<br><br>Distributed multimedia systems: Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems (Chap. 4 - Sections 4.1 to 4.5 of Text 2). | L1, L2, L3 |
| Module-4 | |
| Audio and video compression: Introduction, Audio compression, video compression,videocompressionprinciples,videocompression.(Chap.4of Text1). | L1, L2, L3 |
| Module-5 | |
| Multimedia Communication Across Networks: Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks (Chap. 6 - Sections 6.1, 6.2,<br>6.3 of Text 2). | L1, L2 |

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

- Understand basics of different multimedia networks andapplications.
- Understanddifferentcompressiontechniquestocompressaudioandvideo.
- Describe multimedia Communication acrossNetworks.
- Analyse different media types to represent them in digitalform.
- Compressdifferenttypesoftextandimagesusingdifferentcompression techniques and analyseDMS.

Question pap er pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books:

1. FredHalsall,"MultimediaCommunications",Pearsoneducation,2001ISBN- 9788131709948.
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia CommunicationSystems",Pearsoneducation,2004.ISBN-9788120321458

BIOMEDICAL SIGNAL PROCESSING

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC742 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: The objectives of this course are to:

- Describetheorigin,propertiesandsuitablemodelsofimportantbiologicalsignals such as ECG andEEG.
- Introducestudentstobasicsignalprocessingtechniquesinanalysingbiological signals.
- Developthestudentsmathematicalandcomputationalskillsrelevanttothefieldof biomedical signalprocessing.
- DevelopathoroughunderstandingonbasicsofECGsignalcompression algorithms.
- Increasethestudent'sawarenessofthecomplexityofvariousbiologicalphenomena and cultivate an understanding of the promises, challenges of the biomedical engineering.

| Module-1 | RBT Level |
|---|---|
| Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.<br>Electrocardiography: Basic electrocardiography, ECG lead systems, ECG signal characteristics.<br>Signal Conversion :Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits (Text-1) | L1, L2 |
| Module-2 | |
| Signal Averaging: Basics of signal averaging, signal averaging as adigital filter,atypicalaverager,softwareforsignalaveraging,limitationsofsignal averaging.<br>Adaptive Noise Cancelling: Principal noise canceller model, 60- Hzadaptive cancelling using a sine wave model, other applications of adaptive filtering (Text-1) | L1, L2, L3 |
| Module-3 | |
| Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithmsThe Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG(Text-1) | L1, L2, L3 |
| Module-4 | |

| | |
|---|---|
| Cardiological signal processing:<br>Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Realtime ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor. (Text -2) | L1, L2, L3 |
| Module-5 | |
| Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation.<br><br>Analysis of EEG channels: Detection of EEG rhythms, Template matching for EEG, spike and wave detection(Text-2). | L1, L2, L3 |

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

- Possessthebasicmathematical,scientificandcomputationalskillsnecessaryto analyseECG and EEGsignals.
- ApplyclassicalandmodernfilteringandcompressiontechniquesforECGand EEGsignals
- DevelopathoroughunderstandingonbasicsofECGandEEGfeatureextraction.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- EachfullquestionwillhavesubquestionscoveringallthetopicsunderamoduleThestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books:

1. Biomedical Digital Signal Processing- Willis J. Tompkins, PHI2001.
2. Biomedical Signal Processing Principles and Techniques- D C Reddy, McGraw- Hill publications2005

Reference Book :

Biomedical Signal Analysis- Rangaraj M. Rangayyan, John Wiley & Sons 2002

REAL TIME SYSTEMS

B.E., VII Semester, Electronics &CommunicationEngineering /Telecommunication Engineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC743 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam marks | 80 |
| Total Number of Lecture Hours | 40 (08 Hours per Module) | Exam Hours | 03 |
| Credits – 03 | | | |

Course Objectives: This Course will enable students to:

- DiscussthehistoricalbackgroundofReal-timesystemsanditsclassifications.
- Describe the concepts of computer control and hardware components for Real- TimeApplication.
- DiscussthelanguagestodevelopsoftwareforReal-TimeApplications.
- ExplaintheconceptsofoperatingsystemandRTSdevelopmentmethodologies.

| Modules | RBT Level |
|---|---|
| Module-1 | |
| Introduction to Real -Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification ofPrograms.<br>Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6) | L1, L2 |
| Module-2 | |
| Computer Hardware Requirements for Real -Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8) | L1, L2 |
| Module-3 | |
| Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, InterruptsandDeviceHandling,Concurrency,Real-TimeSupport,Overviewof Real-Time Languages. (Text Book: 5.1 to5.14) | L1, L2, L3 |
| Module-4 | |
| Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11) | L1, L2 |

| | |
|---|---|
| Module-5 | |
| Design of RTS –General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/BackgroundSystem.<br><br>RTS Development Methodologies:Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5) | L1, L2, L3 |

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

- UnderstandthefundamentalsofRealtimesystemsanditsclassifications.
- Understandtheconceptsofcomputercontrol,operatingsystemandthesuitable computer hardware requirements for real-timeapplications.
- Develop the software languages to meet Real timeapplications.
- ApplysuitablemethodologiestodesignanddevelopReal-TimeSystems.

Question Paper Pattern:

- The question paper will have tenquestions.
- Each full Question consisting of 16marks
- There will be 2 full questions (with a maximum of Three sub questions) from eachmodule.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from eachmodule.

Text Book :

Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.

Reference Books:


1. C.M.Krishna,KangG.Shin,"Real–TimeSystems",McGraw–HillInternational Editions,1997.
2. Real-TimeSystemsDesignandAnalysis,Phillip.A.Laplante,secondedition, PHI,2005.
3. EmbeddedSystems,RajKamal,TataMcGrawHill,India,thirdedition,2005.

Cryptography

B.E., VII Semester, Electronics &CommunicationEngineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC744 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (08 Hours / Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This Course will enable students to:

- Enablestudentstounderstandthebasicsofsymmetrickeyandpublickey cryptography.
- Equipstudentswithsomebasicmathematicalconceptsandpseudorandom number generators required forcryptography.
- Enable students to authenticate and protect the encrypteddata.
- Enrich knowledge about Email, IP and Websecurity.

Modules

| Module-1 | RBT Level |
|---|---|
| Basic Concepts of Number Theory and Finite Fields: Divisibility and the divisibility algorithm, Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form GF(p), Polynomial arithmetic, Finite fields of the form GF($2^n$)(Text 1: Chapter3) | L1, L2 |
| Module-2 | |
| Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography (Text 1: Chapter 1) SYMMETRIC CIPHERS: Traditional Block Cipher structure, Data Encryption Standard (DES) (Text 1: Chapter 2: Section1, 2) | L1, L2 |
| Module-3 | |
| SYMMETRIC CIPHERS: The AES Cipher. (Text 1: Chapter 4: Section 2, 3, 4)<br>Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs (Text 2: Chapter 16: Section 1, 2, 3, 4) | L1, L2, L3 |
| Module-4 | |
| More number theory : Prime Numbers, Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, discrete logarithm. (Text 1: Chapter 7)<br>Principles of Public-Key Cryptosystems : The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography (Text 1: Chapter 8, Chapter 9: Section 1, 3,4) | L1, L2, L3 |
| Module-5 | |

| | |
|---|---|
| One-Way Hash Functions: Background, Snefru, N-Hash, MD4,MD5, Secure Hash Algorithm [SHA],One way hash functions using symmetric block algorithms, Using public key algorithms, Choosing a one-way hash functions, Message Authentication Codes. Digital Signature Algorithm, Discrete Logarithm Signature Scheme (Text 2: Chapter 18: Section 18.1 to 18.5, 18.7, 18.11 to 18.14 and Chapter 20: Section 20.1,20.4) | L1, L2, L3 |

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

- Explain the fundamental concepts, principles and theories of cryptography.
- Make use of the concepts of generating pseudo random numbers required for cryptographic applications.
- Utilize the various concepts of number theory in cryptography.
- Discover the prominent techniques used for public-key cryptosystems and digital signature schemes.
- Assess one way hash functions for data encryption.

Question paper pattern:

- Thequestionpaperwillhave10fullquestionscarryingequalmarks.
- Eachfullquestionconsistsof16markswithamaximumofThreesubquestions.
- Therewillbe2fullquestionsfromeachmodulecoveringallthetopicsofthe module
- Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Books :


1. William Stallings , “Cryptography and Network Security Principles and Practice”, Pearson Education Inc., 6th Edition, 2014, ISBN:978-93-325-1877-3
2. Bruce Schneier, “Applied Cryptography Protocols, Algorithms, and Source code in C”, Wiley Publications, 2nd Edition, ISBN:9971-51-348-X


Reference Books :


1. CryptographyandNetworkSecurity,BehrouzA.Forouzan,TMH,2007.
2. Cryptography and Network Security, AtulKahate, TMH,2003.

CAD for VLSI

B.E., VII Semester, Electronics &CommunicationEngineering
[As per Choice Based Credit System (CBCS) scheme]

| Subject Code | 15EC745 | IA Marks | 20 |
|---|---|---|---|
| Number ofLecture Hours/Week | 03 | Exam marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours per Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to:

- UnderstandvariousstagesofPhysicaldesignofVLSIcircuits
- Knowaboutmappingadesignproblemtoarealizablealgorithm
- BecomeawareofgraphtheoretIc,heuristicandgeneticalgorithms
- Compare performance of differentalgorithms

| Modules | RBT Level |
|---|---|
| Module 1 | |
| Data Structures and Basic Algorithms:<br>Basic terminology, Complexity issues and NP-Hardness. Examples - Exponential, heuristic, approximation and special cases. Basic Algorithms. Graph Algorithms for Search, spanning tree, shortest path, min-cut and max-cut, Steiner tree. Computational Geometry Algorithms: Line sweep and extended<br>line sweep methods. | L1, L2 |
| Module 2 | |
| Basic Data Structures. Atomic operations for layout editors, Linked list of blocks, Bin-based method, Neighbor pointers, corner-stitching, Multi-layer operations, Limitations of existing data structures. Layout specificationlanguages.<br><br>Graph algorithms for physical design : Classes of graphs in physical design, Relationship between graph classes, Graph problems in physical design, Algorithms for Interval graphs,<br>permutation graphs and circle graphs. | L1, L2 |
| Module 3 | |
| Partitioning: Problem formulation, Design style specific partitioning problems, Classification of Partitioning Algorithms.<br><br>Group migration algorithms: Kernighan-Lin algorithm, Fiduccia-MattheysesAlgorithm,SimulatedAnnealing,SimulatedEvolution.<br><br>Floor Planning: Problem formulation, Constraint based floor planning, Rectangular dualization, Simulated evolution algorithms. | L1, L2,L3 |

| | |
|---|---|
| Module 4 | |
| Pin Assignment : Problem formulation. Classification of pin assignment problems, General pin assignment problem.<br><br>Placement: Problem formulation, Classification of placement algorithms. Simulation based placement: Simulated annealing, simulated evolution, force directed placement. Partitioning based algorithms: Breur's Algorithm, Terminal propagation algorithm, Other algorithms for placement. | L1,L2,L3 |
| Module 5 | |
| Global Routing: Problem formulation, Classification of Global routing algorithms, Maze routing algorithms: Lee's algorithm, Soukup's algorithm and Hadlock's Algorithm, Line probe algorithms.<br><br>Detailed Routing: Problem formulation, Routing considerations, models, channel routing and switch box routing problems. General river routing problem, Single row routing problem.<br><br>Two-layer channel routing algorithms: Basic Left EdgeAlgorithm, Dogleg router, Symbolic router-YACR2. | L1,L2,L3 |
| Course Outcomes: After studying this course, students will be able to:<br>• AppreciatetheproblemsrelatedtophysicaldesignofVLSI<br>• UsegenralizedgraphtheoreticapproachtoVLSIproblems<br>• Design Simulated Annealing and Evolutionaryalgorithms<br>• Know various approaches to write generalizedalgorithms | |
| Question paper pattern:<br><br>• Thequestionpaperwillhave10fullquestionscarryingequalmarks.<br>• Eachfullquestionconsistsof16markswithamaximumofThreesub questions.<br>• Therewillbe2fullquestionsfromeachmodulecoveringallthetopics of themodule<br>• Thestudentswillhavetoanswer5fullquestions,selectingonefull question from eachmodule. | |

Text Book :

Algorithms for VLSI Physical Design Automation, 3rdEd, NaveedSherwani, 1999 Kluwer Academic Publishers, Reprint 2009 Springer (India) Private Ltd. ISBN 978-81-8128-317-7.

Reference Book :

Raifsteinmetz,KlaraNahrstedt,"Multimedia:Computing,Communicationsand Applications", Pearson education, 2002. ISBN-9788177584417

DSP Algorithms and Architecture

B.E., VII Semester, Electronics &CommunicationEngineering /Telecommunication Engineering

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

| Subject Code | 15EC751 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to:

- Figureouttheknowledgeandconceptsofdigitalsignalprocessingtechniques.
- Understandthecomputationalbuildingblocksof DSPprocessorsanditsspeed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xxprocessor.
- Learn how to interface the external devices to TMS320C54xx processor in variousmodes.
- Understand basic DSP algorithms with theirimplementation.

| Module-1 | RBT Level |
|---|---|
| Introduction to Digital SignalProcessing:<br>Introduction,ADigitalSignal–ProcessingSystem,TheSamplingProcess, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation andInterpolation.<br><br>Computational Accuracy in DSP Implementations:<br>Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation. | L1, L2 |
| Module-2 | |
| Architectures for Programmable Digital Signal – Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, AddressGenerationUnit,ProgrammabilityandProgramExecution,Speed Issues, Features for ExternalInterfacing. | L1, L2, L3 |
| Module-3 | |
| Programmable Digital Signal Processors:<br>Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On – Chip Peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation ofTMS32OC54xx<br>Processor. | L1, L2, L3 |
| Module-4 | |

| | |
|---|---|
| Implementation of Basic DSPAlgorithms:<br>Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).<br><br>Implementation of FFT Algorithms:<br>Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx. | L1, L2, L3 |
| Module-5 | |
| InterfacingMemory and Parallel I/O Peripherals to Programmable DSPDevices:<br>Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).<br><br>Interfacing and Applications of DSP Processors:<br>Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSPBasedBio-telemetryReceiver,ASpeechProcessingSystem,AnImage ProcessingSystem. | L1, L2, L3 |
| Course Outcomes: At the end of this course, students would be able to<br>• Comprehend the knowledge and concepts of digital signal processing techniques.<br>• Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture orprocessor.<br>• Apply knowledge of various types of addressing modes, interrupts, peripheralsandpipeliningstructureofTMS320C54xxprocessor.<br>• Develop basic DSP algorithms using DSPprocessors.<br>• Discussaboutsynchronousserialinterfaceandmultichannelbuffered serial port (McBSP) of DSPdevice.<br>• Demonstrate the programming of CODECinterfacing. | |
| Question paper pattern:<br>• Thequestionpaperwillhave10fullquestionscarryingequalmarks.<br>• Eachfullquestionconsistsof16markswithamaximumofThreesubquestions.<br>• Therewillbe2fullquestionsfromeachmodulecoveringallthetopicsofthe module<br>• Thestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule. | |
| Text Book:<br>"Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004. | |
| Reference Books:<br>1. "DigitalSignalProcessing:Apracticalapproach",IfeachorE.C.,JervisB.W Pearson-Education, PHI,2002.<br>2. "DigitalSignalProcessors",BVenkataramaniandMBhaskar,TMH,2nd,2010<br>3. "ArchitecturesforDigitalSignalProcessing",PeterPirschJohnWeily,2008 | |

IoT& WIRELESS SENSOR NETWORKS

B.E., VII Semester, Electronics &CommunicationEngineering /Telecommunication Engineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC752 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of LectureHours | 40 (8 Hours /Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to:

- UnderstandvarioussourcesofIoT&M2Mcommunicationprotocols.
- Describe Cloud computing and design principles ofIoT.
- BecomeawareofMQTTclients,MQTTserveranditsprogramming.
- Understand the architecture and design principles ofWSNs.
- EnrichtheknowledgeaboutMACandroutingprotocolsin WSNs.

| Module-1 | RBT Level |
|---|---|
| Overview of Internet of Things: IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP- MQ, MQTT,XMPP) for IoT/M2M devices. | L1, L2 |
| Module-2 | |
| Architectureand Design Principles for IoT: Internet connectivity, Internet-basedcommunication,IPv4,IPv6,6LoWPANprotocol,IPAddressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports.<br><br>Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits. | L1, L2 |
| Module-3 | |

| | |
|---|---|
| Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.<br><br>ProgrammingMQTTclientsandMQTTserver.IntroductiontoIoTprivacy andsecurity.Vulnerabilities,securityrequirementsandthreatanalysis, IoT Security Tomography and layered attackermodel. | L1, L2, L3 |
| Module-4 | |
| Overview of Wireless Sensor Networks:<br>Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.<br><br>Architectures: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts. | L1, L2, L3 |
| Module-5 | |
| Communication Protocols :<br>Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols(CSMA,PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols-Energy-Efficient Routing,GeographicRouting,Hierarchicalnetworksbyclustering. | L1, L2, L3 |
| Course Outcomes: At the end of the course, students will be able to:<br>• Describe the OSI Model for the IoT/M2MSystems.<br>• Understand the architecture and design principles forIoT.<br>• Learn the programming for IoTApplications.<br>• IdentifythecommunicationprotocolswhichbestsuitstheWSNs. | |
| Question paper pattern:<br>• The question paper will have tenquestions.<br>• Each full Question consisting of 16marks.<br>• There will be 2 full questions (with a maximum of Three sub questions) fromeach module.<br>• Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.<br>• The students will have to answer 5 full questions, selecting one full questionfrom eachmodule. | |

Text Books:

1. Raj Kamal, ”Internet of Things-Architecture and design principles”, McGraw Hill Education.
2. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks" , John Wiley,2005.
3. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier,2007.

Reference Books:

1. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley,2007.
2. AnnaHac,“WirelessSensorNetworkDesigns”,JohnWiley,2003.

PATTERN RECOGNITION

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

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC753 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |

Course Objectives: The objectives of this course are to:

- Introduce mathematical tools needed for PatternRecognition
- Impart knowledge about the fundamentals of PatternRecognition.
- Provideknowledgeofrecognition,decisionmakingandstatisticallearning problems
- Introduceparametricandnon-parametrictechniques,supervisedlearningand clustering concepts of patternrecognition

Modules

| Module-1 | RBT Level |
|---|---|
| Introduction: Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. | L1, L2 |
| Module-2 | |
| Data Transformationand Dimensionality Reduction: Introduction, Basis Vectors, The KarhunenLoeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introductiononly).<br>Nonlinear Dimensionality Reduction, Kernel PCA. | L1, L2 |
| Module-3 | |
| Estimationof Unknown ProbabilityDensity Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture<br>Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. | L1, L2, L3 |
| Module-4 | |
| Linear Classifiers: Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error<br>Estimate. | L1, L2, L3 |
| Module-5 | |
| NonlinearClassifiers:TheXORProblem,ThetwoLayerPerceptron,Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , ProximityMeasures. | L1, L2, L3 |

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

- IdentifyareaswherePatternRecognitionandMachineLearningcanoffera solution.
- Describethestrengthandlimitationsofsometechniquesusedincomputational MachineLearningforclassification,regressionanddensityestimationproblems
- Describegeneticalgorithms,validationmethodsandsamplingtechniques
- Describeandmodeldatatosolveproblemsinregressionandclassification
- Implement learning algorithms for supervisedtasks

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)from eachmodule.
- Each full question will have sub questions covering all the topics under a module.Thestudentswillhavetoanswer5fullquestions,selectingonefull question from eachmodule.

Text Book:

Pattern Recognition :SergiosTheodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Paper Back), 4th edition.

Reference Books:


1. TheElementsofStatisticalLearning:TrevorHastie,Springer-VerlagNew York, LLC (Paper Back),2009.
2. PatternClassification:RichardO.Duda,PeterE.Hart,DavidG.Stork. John Wiley & Sons,2012.
3. PatternRecognitionandImageAnalysisEarlGose:Richard

   Johnsonbaugh,SteveJost,ePubeBook

ADVANCED COMPUTER ARCHITECTURE

B.E., VII Semester, Electronics &CommunicationEngineering /Telecommunication Engineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15EC754 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to:

- Understandthevariousparallelcomputermodelsandconditionsofparallelism
- Explain the control flow, dataflow and demand drivenmachines
- StudyCISC,RISC,superscalar,VLIWandmultiprocessorarchitectures
- Understandtheconceptofpipeliningandmemoryhierarchydesign
- Explain cache coherenceprotocols.

| Module-1 | RBT Level |
|---|---|
| Parallel Computer Models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivectorsand SIMD computers.<br>Program and Network Properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency. | L1, L2 |
| Module-2 | |
| Program flow mechanisms: Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.<br>Principles of Scalable Performance : Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. | L1, L2, L3 |
| Module-3 | |
| Speedup Performance Laws: Amdhal's law, Gustafson's law, Memory bounded speed up model, Scalability Analysis and Approaches.<br>Advanced Processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures. | L1, L2, L3 |
| Module-4 | |
| Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design.<br>Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies. | L1, L2, L3 |

| Module-5 | |
|---|---|
| Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memoryconsistency, cachecoherenceprotocols(MSI,MESI,MOESI),scalablecachecoherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols. | L1, L2, L3 |

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

- Explain parallel computer models and conditions ofparallelism
- Differentiate control flow, dataflow, demand drivenmechanisms
- Explain the principle of scalableperformance
- Discuss advanced processors architectures like CISC, RISC, superscalar and VLIW
- Understand the basics of instruction pipelining and memorytechnologies
- Explain the issues in multiprocessorarchitectures

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16marks.
- Therewillbe2fullquestions(withamaximumofThreesubquestions)fromeach module.
- EachfullquestionwillhavesubquestionscoveringallthetopicsunderamoduleThestudentswillhavetoanswer5fullquestions,selectingonefullquestionfrom eachmodule.

Text Book:

Kai Hwang, “Advanced computer architecture”; TMH.

Reference Books:


1. KaiHwangandZu,“ScalableParallelComputersArchitecture”;MGH.
2. M.JFlynn,“ComputerArchitecture,PipelinedandParallelProcessorDesign”; NarosaPublishing.
3. D.A.Patterson,J.L.Hennessy,“ComputerArchitecture:Aquantitativeapproach”; Morgan Kauffmann Feb,2002.

SATELLITE COMMUNICATION

B.E., VII Semester, Electronics &CommunicationEngineering

[As per Choice Based Credit System (CBCS)]

| | | | |
|---|---|---|---|
| Subject Code | 15EC755 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 (8 Hours /Module) | Exam Hours | 03 |

CREDITS – 03

Course Objectives: This course will enable students to

- Understand the basic principle of satellite orbits andtrajectories.
- Studyofelectronicsystemsassociatedwithasatelliteandtheearthstation.
- Understandthevarioustechnologiesassociatedwiththesatellitecommunication.
- Focusonacommunicationsatelliteandthenationalsatellitesystem.
- Studyofsatelliteapplicationsfocusingvariousdomainsservicessuchasremote sensing, weather forecasting andnavigation.

| Module-1 | RBT Level |
|---|---|
| Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle. | L1, L2 |
| Module-2 | |
| Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.<br><br>Earth Station: Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking. | L1, L2 |
| Module-3 | |
| Multiple Access Techniques : Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA.<br><br>Satellite Link Design Fundamentals : Transmission Equation, Satellite Link Parameters, Propagationconsiderations. | L1, L2, L3 |
| Module-4 | |
| Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems. | L1, L2 |
| Module-5 | |

| | |
|---|---|
| Remote Sensing Satellites : Classification of remote sensingsystems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications.<br><br>Weather Forecasting Satellites: Fundamentals, Images, Orbits, Payloads, Applications.<br><br>Navigation Satellites : Development of Satellite Navigation Systems, GPS system, Applications. | L1, L2, L3 |

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

- Identify the various applications of satellite orbits and its trajectoriesand subsystem parameters associated with it.
- Utilize the electronic hardware requirements associated with thesatellite subsystem and earth station.
- Make use of the satellite link parameters under various propagationconditions and applications with the different multiple accesstechniques.
- Develop the knowledge of communication satellite and focus onnational satellite system.
- Distinguish applications of satellite in different domains such asremote sensing, weather forecasting and navigation.

Question Paper pattern:

- The Question paper will have tenquestions.
- Each full Question consisting of 16marks
- Therewillbe2fullQuestions(withamaximumofThreesubquestions)fromeach module.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- The Students will have to answer 5 full Questions, selecting one full Question from eachmodule.

Text Book:

AnilK.Maini,VarshaAgrawal,SatelliteCommunications,WileyIndiaPvt.Ltd., 2015, ISBN:978-81-265-2071-8.

Reference Books :


1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition,2006
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN:978-81-265-0833-4

ADVANCED COMMUNICATION LAB

B.E., VII Semester, Electronics &CommunicationEngineering

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

| Subject Code | 15ECL76 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 01Hr Tutorial(Instructions) + 02 Hours Laboratory = 03 | Exam Marks | 80 |
| RBT Levels | L1, L2, L3 | Exam Hours | 03 |
| CREDITS – 02 | | | |

Course objectives: This course will enable students to:

- Design and demonstrate the digital modulationtechniques
- Demonstrateandmeasurethewavepropagationinmicrostripantennas
- Characteristicsofmicrostripdevicesandmeasurementofitsparameters.
- Modelanopticalcommunicationsystemandstudyitscharacteristics.
- Simulatethedigitalcommunicationconceptsandcomputeanddisplayvarious parameters along withplots/figures.

Laboratory Experiments

PART-A: Following Experiments No. 1 to 4 has to be performed using discrete components.

1. TimeDivisionMultiplexingandDemultiplexingoftwobandlimitedsignals.
2. ASKgenerationanddetection
3. FSKgenerationanddetection
4. PSKgenerationanddetection
5. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave testbench.
6. MeasurementofdirectivityandgainofmicrostripdipoleandYagiantennas.
7. Determinationof
    a. Couplingandisolationcharacteristicsofmicrostripdirectionalcoupler.
    b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of thesubstrate.
    c. Power division and isolation of microstrip powerdivider.
8. Measurement of propagation loss, bending loss and numerical aperture of an opticalfiber.

PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabView

1. Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polarsignaling.
2. Simulate the Pulse code modulation and demodulation system and display the waveforms.
3. SimulatetheQPSKtransmitterandreceiver.Plotthesignalsanditsconstellation diagram.
4. Test the performance of a binary differential phase shift keying system by simulating the non-coherent detection of binaryDPSK.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Make use of the characteristics and response of microwave devices
- Utilize the characteristics of micros trip antennas and measurement of its parameters.
- Construct the digital modulation schemes with the display of waveforms and computation of performance parameters
- Make use of the characteristics of Optical Fibre Communication and calculate the parameters associated with it.
- Model different digital communication concepts using simulation

Conduct of Practical Examination:

- Alllaboratoryexperimentsaretobeconsideredforpractical examination.
- For examination one question from PART-A and one question from PART-B or only onequestionfromPART-Bexperimentsbasedonthecomplexity,tobeset.
- Students are allowed to pick one experiment from thelot.
- Strictlyfollowtheinstructionsasprintedonthecoverpageofanswerscriptfor breakup ofmarks.
- ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedurepart to be madezero.

VLSI LAB

B.E., VII Semester, Electronics &CommunicationEngineering

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

| | | | |
|---|---|---|---|
| Subject Code | 15ECL77 | IA Marks | 20 |
| Number of Lecture Hours/Week | 01Hr Tutorial(Instructions) + 02 Hours Laboratory = 03 | Exam Marks | 80 |
| RBT Levels | L1, L2, L3 | Exam Hours | 03 |

CREDITS – 02

Course objectives: This course will enable students to:

- ExploretheCADtoolandunderstandtheflowoftheFullCustomICdesigncycle.
- Learn DRC, LVS and Parasitic Extraction of the variousdesigns.
- DesignandsimulatethevariousbasicCMOSanalogcircuitsandusetheminhigher circuits like data converters using design abstractionconcepts.
- DesignandsimulatethevariousbasicCMOSdigitalcircuitsandusetheminhigher circuitslikeaddersandshiftregistersusingdesignabstractionconcepts.

Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind

Laboratory Experiments

PART - A

ASIC-DIGITAL DESIGN

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
   i. Aninverter
   ii. ABuffer
   iii. TransmissionGate
   iv. Basic/universalgates
   v. Flip flop -RS, D, JK, MS,T
   vi. Serial & Paralleladder
   vii. 4-bit counter [Synchronous and Asynchronouscounter]
   viii. Successive approximation register[SAR]

PART - B ANALOG DESIGN

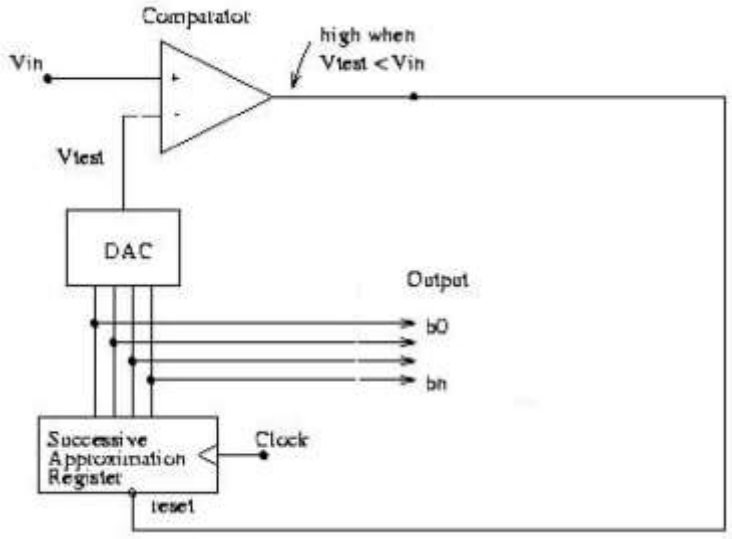
1. Design an Inverter with given specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify thefollowing
      i) DCAnalysis
      ii) TransientAnalysis
   b. Draw the Layout and verify the DRC,ERC
   c. Check forLVS
   d. Extract RC and back annotate the same and verify theDesign
   e. Verify&Optimize forTime,PowerandAreatothegivenconstraint*

2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stagedifferentialamplifier,withgivenspecifications**,completingthe design flow mentioned below:
   a. Draw the schematic and verify thefollowing
      i) DCAnalysis
      ii) ACAnalysis
      iii) TransientAnalysis
   b. Draw the Layout and verify the DRC,ERC
   c. Check forLVS
   d. Extract RC and back annotate the same and verify theDesign.

3. Design an op-amp with given specification** using given differential amplifier CommonsourceandCommonDrainamplifierinlibrary***andcompletingthe design flow mentionedbelow:
   a. Draw the schematic and verify the following
      i) DC Analysis ii).
      ACAnalysis
      iii) Transient Analysis
   b. Draw the Layout and verify the DRC,ERC
   c. Check forLVS
   d. Extract RC and back annotate the same and verify theDesign.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in thelibrary***.
   a. Draw the schematic and verify thefollowing
      i) DCAnalysis
      ii) ACAnalysis
      iii) TransientAnalysis
   b. Draw the Layout and verify the DRC,ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW. [Specifications to GDS-II]




* An appropriate constraint should begiven.

** Appropriate specification should begiven.

*** ApplicableLibraryshouldbeadded&informationshouldbegiventothe Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Model basic digital circuits,simulate and synthesize using EDA Tool.
- Make use of logic gates to realize shift registers and adders to meet desired parameters.
- Construct and generate layout structure for basic CMOS circuits like inverter, common source amplifier and differential amplifier.
- Experiment with the basic amplifiers to design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Inspect concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.

Conduct of Practical Examination:

- Alllaboratoryexperimentsare tobeincludedforpracticalexamination.
- For examination, one question from PART-A and one question from PART-B to beset.
- Students are allowed to pick one experiment from thelot.
- ChangeofexperimentisallowedonlyonceandMarksallottedtotheprocedure part to be madezero.