

**B.E., III Semester, Electronics & Communication Engineering
/Telecommunication Engineering**

ENGINEERING MATHEMATICS-III B.E., III Semester, Common to all Branches [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits – 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none"> • Introduce most commonly used analytical and numerical methods in the different engineering fields. • Learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods. • Solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Modules			RBT Level
Module-1			
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π 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. 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 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 $y = ae^{bx}$. 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 without proof)-Problems. 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. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems.	L3, L4 L2, L4
Course outcomes: On completion of this course, students are able to: <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functionals and solve the simple problems of the calculus of variations. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • 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 each module. 	
Text Books: <ol style="list-style-type: none"> 1. B.S. Grewal: <i>Higher Engineering Mathematics</i>, Khanna Publishers, 43rd Ed., 2015. 2. E. Kreyszig: <i>Advanced Engineering Mathematics</i>, John Wiley & Sons, 10th Ed., 2015. 	
Reference Books: <ol style="list-style-type: none"> 1. N.P.Bali and Manish Goyal: <i>A Text Book of Engineering Mathematics</i>, Laxmi Publishers, 7th Ed., 2010. 2. B.V.Ramana: <i>"Higher Engineering Mathematics"</i> Tata McGraw-Hill, 2006. 3. H. K. Dass and Er. Rajnish Verma: <i>"Higher Engineering Mathematics"</i>, S. Chand publishing, 1st edition, 2011. 	
Web Link and Video Lectures: <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

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Dept. Of Electronics & Communication
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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: <ul style="list-style-type: none"> • Explain various BJT parameters, connections and configurations. • Explain BJT Amplifier, Hybrid Equivalent and Hybrid Models. • Explain construction and characteristics of JFETs and MOSFETs. • Explain various types of FET biasing, and demonstrate the use of FET amplifiers. • Construct frequency response of BJT and FET amplifiers at various frequencies. • Analyze Power amplifier circuits in different modes of operation. • Construct Feedback and Oscillator circuits using FET. 			
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. 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, High frequency response-FET Amplifier, Multistage Frequency 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
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers. • Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT. • Calculate the AC gain and impedance for BJT using re and h parameters models for CE and CC configuration. • Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model. • Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics. • Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
<p>Text Book:</p> <p>Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Application", 5th Edition ISBN:0198062257 2. Fundamentals of Microelectronics, Behzad Razavi, John Wiley ISBN 2013 978-81-265-2307-8 3. J.Millman & C.C.Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5 4. K. A. Navas, "Electronics Lab Manual", Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424. 	

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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: <ul style="list-style-type: none"> • Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques. • Design combinational logic circuits. • Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators. • Describe Latches and Flip-flops, Registers and Counters. • Analyze Mealy and Moore Models. • Develop state diagrams Synchronous Sequential Circuits. 			
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, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.(Text 1, Chapter 4)			L1, L2, L3
Module -3			
Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations. (Text 2, 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 using clocked T , JK , D and SR flip-flops. (Text 2, Chapter 6)			L1,L2, L3

Module -5	
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. (Text 1, Chapter 6)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques. • Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators. • Explain the working of Latches and Flip Flops (SR,D,T and JK). • Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops. • Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. • Apply the knowledge gained in the design of Counters and Registers. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1. 2. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2002. ISBN 978-0-07-052906-9. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. D. P. Kothari and J. S Dhillon, "Digital Circuits and Design", Pearson, 2016, ISBN:9789332543539. 2. Morris Mano, "Digital Design", Prentice Hall of India, Third Edition. 3. Charles H Roth, Jr., "Fundamentals of logic design", Cengage Learning. 4. K. A. Navas, "Electronics Lab Manual", Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424. 	



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<u>ELECTRONIC INSTRUMENTATION</u> [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: <ul style="list-style-type: none"> • Define and describe accuracy and precision, types of errors, statistical and probability analysis. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of various Analog and Digital measuring instruments. • Describe basic concepts and operation of Digital Voltmeters and Microprocessor based instruments. • Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges. • Recognize and describe significance and working of different types of transducers. 			
Modules			RBT Level
Module -1 Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations, Basics of Statistical Analysis. (Text 2) 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) 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			

<p>Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Continuous Balance DVM, 3½-Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, Microprocessor based Ramp type DVM. (Text 1)</p> <p>Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, Microprocessor based Instruments. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -3</p>	
<p>Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Storage Oscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)</p> <p>Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, Square and Pulse Generator, Sweep Generator. (Text 1)</p>	<p>L1, L2</p>
<p>Module -4</p>	
<p>Measuring Instruments: Output Power Meters, Field Strength Meter, Stroboscope, Phase Meter, Vector Impedance Meter, Q Meter, Megger, Analog pH Meter. (Text 1)</p> <p>Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -5</p>	
<p>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, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo diode and transistor, Temperature transducers-RTD. (Text 1)</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe instrument measurement errors and calculate them. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions. • Describe functional concepts and operation of various Analog measuring instruments to measure output power, field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance and pH. • Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers. • Utilize AC and DC bridges for passive component and frequency measurements. 	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- 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 each module.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.

Reference Books:

1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN:9789332556065.
2. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai & Sons. ISBN -81-7700-016-0



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Dept. Of Electronics & Communication
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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: <ul style="list-style-type: none">• Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.• Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.• Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions.• Infer the effects of magnetic forces, materials and inductance.• Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behaviour in different media• Acquire knowledge of Poynting theorem and its application of power flow.			
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 Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ∇ and divergence theorem.			L1, L2, L3
Energy, Potential and Conductors Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current.			
Module -3			
Poisson's and Laplace's Equations Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation. Steady Magnetic Field Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials.			L1, L2, L3
Module -4			

Magnetic Forces Force on a moving charge, differential current elements, Force between differential current elements.	L1, L2, L3
Magnetic Materials Magnetisation and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials.	
Module -5	
Time-varying fields and Maxwell's equations Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.	L1, L2, L3
Uniform Plane Wave Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect.	
Course Outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. • Determine potential and energy with respect to point charge and capacitance using Laplace equation. • Calculate magnetic field, force, and potential energy with respect to magnetic materials. • Apply Maxwell's equation for time varying fields, EM waves in free space and conductors. • Evaluate power associated with EM waves using Poynting theorem. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Book: W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2009, ISBN-978-0-07-061223-5.	
Reference Books: <ol style="list-style-type: none"> 1. John Krauss and Daniel A Fleisch, " Electromagnetics with applications", McGraw-Hill. 2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson. 	

D.V. g

ANALOG ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III (EC/TC)			
Laboratory Code	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 evaluation of: <ul style="list-style-type: none"> • Rectifiers and Voltage Regulators. • BJT characteristics and Amplifiers. • JFET Characteristics and Amplifiers. • MOSFET Characteristics and Amplifiers • Power Amplifiers. • RC-Phase shift, Hartley, Colpitts and Crystal Oscillators. 			
NOTE: The experiments are to be carried using discrete components only.			
Laboratory Experiments:			
1. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency: (a) Full Wave Rectifier (b) Bridge Rectifier			
2. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).			
3. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.			
4. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.			
5. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.			
6. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.			
7. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.			

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
10. Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
11. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
12. Design and set-up the crystal oscillator and determine the frequency of oscillation.
Course Outcomes: On the completion of this laboratory course, the students will be able to: <ul style="list-style-type: none"> • Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators. • Determine the characteristics of BJT and FET amplifiers and plot its frequency response. • Compute the performance parameters of amplifiers and voltage regulators • Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators.
Conduct of Practical Examination: <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.



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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) + 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 verification of <ul style="list-style-type: none"> • Demorgan's Theorem, SOP, POS forms • Full/Parallel Adders, Subtractors and Magnitude Comparator • Multiplexer using logic gates • Demultiplexers and Decoders • Flip-Flops, Shift registers and Counters 			
NOTE: <ol style="list-style-type: none"> 1. Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used. 2. For experiment No. 11 and 12 any open source or licensed simulation tool may be used. 			
Laboratory Experiments:			
1. Verify (a) Demorgan's Theorem for 2 variables. (b) The sum-of product and product-of-sum expressions using universal gates.			
2. Design and implement (a) Full Adder using basic logic gates. (b) Full subtractor using basic logic gates.			
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 using gates. (b) 3-variable function using IC 74151(8:1MUX).			
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.			
7. Realize the following flip-flops using NAND Gates. (a) Clocked SR Flip-Flop (b) JK Flip-Flop.			
8. Realize the following shift registers using IC7474 (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:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
- Construct and test flips-flops, counters and shift registers.
- Simulate full adder and up/down counters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.



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B.E E&C FOURTH SEMESTER SYLLABUS

ENGINEERING MATHEMATICS-IV B.E., IV Semester, Common to all Branches [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits – 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none"> • Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. 			
Modules			RBT Level
Module-1			
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).			L1, L3
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method. Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$ -Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue's formula, problems.			L3
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems.			L1, L3,
Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z+(1/z)(z \neq 0)$ and bilinear transformations-problems.			L3
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.			L3

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.	
Module-5	
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.	L3
Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.	L1
Course Outcomes: On completion of this course, students are able to: <ul style="list-style-type: none"> • Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods. • Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory. • Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing. • Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems. • Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering. • Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis. • Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events. • Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • 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 each module. 	
Text Books: 1. B.S. Grewal: <i>Higher Engineering Mathematics</i> , Khanna Publishers, 43 rd Ed., 2015.	

2. E. Kreyszig: <i>Advanced Engineering Mathematics</i> , John Wiley & Sons, 10 th Ed., 2015.	
Reference Books: 1. N.P.Bali and Manish Goyal: <i>A Text Book of Engineering Mathematics</i> , Laxmi Publishers, 7 th Ed., 2010. 2. B.V.Ramana: <i>"Higher Engineering Mathematics"</i> Tata McGraw-Hill, 2006. 3. H. K. Dass and Er. Rajnish Verma: <i>"Higher Engineering Mathematics"</i> , S. Chand publishing, 1 st edition, 2011.	
Web Link and Video Lectures: 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math	


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MICROPROCESSORS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV (EC/TC)			
Subject Code	15EC42	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: <ul style="list-style-type: none"> Familiarize basic architecture of 8086 microprocessor Program 8086 Microprocessor using Assembly Level Language Use Macros and Procedures in 8086 Programs Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures 			
Modules			RBT Level
Module -1			
8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text). Addressing modes, Machine language instruction formats, Machine coding the program (2.2, 2.1, 3.2 of Text). INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text).			L1, L2, L3
Module -2			
Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text).			L1, L2, L3
Module -3			
Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Passing parameters to procedures, Macros, Timing and Delays. (Chap. 4 of Text).			L1, L2, L3
Module -4			

<p>8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).</p> <p>Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255 (Refer 5.3, 5.4, 5.5 of Text).</p>	<p>L1, L2, L3</p>
<p>Module 5</p>	
<p>Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes (refer 6.1 of Text).</p> <p>INT 21H DOS Function calls - for handling Keyboard and Display (refer Appendix-B of Text).</p> <p>Other Architectures: Architecture of 8088 (refer 1.10 upto 1.10.1 of Text) and Architecture of NDP 8087 (refer 8.3.1, 8.3.5 of Text).</p> <p>Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students will be able to:</p> <ul style="list-style-type: none"> • Explain the History of evolution of Microprocessors, Architecture and instruction set of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086. • Write 8086 Assembly level programs using the 8086 instruction set • Write modular programs using procedures and macros. • Write 8086 Stack and Interrupts programming • Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors. • Use INT 21 DOS interrupt function calls to handle Keyboard and Display. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	

Text Book:

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

Reference Books:

1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and A. Gibson, 2nd edition, PHI -2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** – Kenneth J Ayala, CENGAGE Learning, 2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.



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CONTROL SYSTEMS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - IV (EC/TC)			
Subject Code	15EC43	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: <ul style="list-style-type: none"> • Understand the basic features, configurations and application of control systems. • Understand various terminologies and definitions for the control systems. • Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems. • Know how to find time response from the transfer function. • Find the transfer function via Masons' rule. • Analyze the stability of a system from the transfer function. 			
Modules			RBT Level
Module -1			
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.			L1, L2, L3
Module -2			
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).			L1, L2, L3
Module -3			
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.			L1, L2, L3
Module -4			

Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).	L1, L2, L3
Module -5	
Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalisation.	L1, L2, L3
Course Outcomes: At the end of the course, the students will be able to <ul style="list-style-type: none"> • Develop the mathematical model of mechanical and electrical systems • Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method • Determine the time domain specifications for first and second order systems • Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. • Determine the stability of a system in the frequency domain using Nyquist and bode plots • Develop a control system model in continuous and discrete time using state variable techniques 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Book: J.Nagarath and M.Gopal, " Control Systems Engineering", New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.	
Reference Books: <ol style="list-style-type: none"> 1. "Modern Control Engineering," K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7. 2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 3. "Feedback and Control System," Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007. 	

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SIGNALS AND SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC44	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: <ul style="list-style-type: none"> Understand the mathematical description of continuous and discrete time signals and systems. Analyze the signals in time domain using convolution difference/differential equations Classify signals into different categories based on their properties. Analyze Linear Time Invariant (LTI) systems in time and transform domains. Build basics for understanding of courses such as signal processing, control system and communication. 			
Modules			RBT Level
Module -1			
Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc functions. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding. Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.			L1, L2, L3
Module -2			
Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.			L1, L2, L3
Module -3			

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours).	L1, L2, L3
Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours).	
Module -4	
Fourier Representation of aperiodic Signals: FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours). FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours). Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours).	L1, L2, L3
Module -5	
Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems.	L1, L2, L3
Course Outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals. Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems. Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis. Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems. 	
Question paper pattern: <ul style="list-style-type: none"> The question paper will have ten questions. Each full Question consisting of 16 marks There will be 2 full questions (with a maximum of Three sub questions) from each module. 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 each module. 	
Text Book: Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.	

Reference Books:

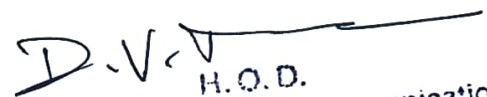
1. **Michael Roberts**, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan**, "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.


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PRINCIPLES OF COMMUNICATION SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC45	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: <ul style="list-style-type: none"> • Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals. • Understand the concepts in Angle modulation for the design of communication systems. • Design simple systems for generating and demodulating frequency modulated signals. • Learn the concepts of random process and various types of noise. • Evaluate the performance of the communication system in presence of noise. • Analyze pulse modulation and sampling techniques. 			
Modules			RBT Level
Module - 1			
AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency - Domain description, Switching modulator, Envelop detector. DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency - Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text).			L1, L2, L3
Module - 2			
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text).			L1, L2, L3
Module - 3			

<p>RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions (refer Chapter 5 of Text).</p> <p>NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text).</p>	L1, L2, L3
Module – 4	
<p>NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text).</p>	L1, L2, L3
Module – 5	
<p>DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Determine the performance of analog modulation schemes in time and frequency domains. • Determine the performance of systems for generation and detection of modulated analog signals. • Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms. • Characterize the influence of channel on analog modulated signals • Determine the performance of analog communication systems. • Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
<p>Text Book:</p> <p>Communication Systems, Simon Haykins & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.</p>	
Reference Books:	

1. **Modern Digital and Analog Communication Systems**, B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems: Analog and Digital**, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.



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LINEAR INTEGRATED CIRCUITS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV (EC/TC)			
Subject Code	15EC46	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: <ul style="list-style-type: none"> Define and describe various parameters of Op-Amp, its characteristics and specifications. Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits. Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters. Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate. Describe and Sketch the various switching circuits of Op-Amps and analyze its operations. Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs. 			
Modules			RBT Level
Module -1			
Operational Amplifier Fundamentals: Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. OP-Amps as DC Amplifiers – Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet.(Text1)			L1, L2,L3
Module -2			
Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance – Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.(Text1)			L1, L2,L3
Module-3			
More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider. (Text2)			L1, L2,L3

Module -4	
Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. (Text 1) Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. (Text 2)	L1, L2,L3
Module -5	
Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. (Text 2)	L1, L2,L3
Course Outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. • Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. • Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. • Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. • Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. • Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Books: <ol style="list-style-type: none"> 1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9. 2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1. 	

Reference Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, "Linear Integrated Circuits: Analysis, Design & Applications," Wiley India, 1st Edition, 2015.
3. James Cox, "Linear Electronics Circuits and Devices", Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.


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<p style="text-align: center;"><u>MICROPROCESSOR LABORATORY</u> [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV (EC/TC)</p>			
Laboratory Code	15ECL47	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			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Get familiarize with 8086 instructions and DOS 21H interrupts and function calls. • Develop and test assembly language programs to use instructions of 8086. • Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications. 			
Laboratory Experiments:			
<p>1. Programs involving:</p> <p>Data transfer instructions like:</p> <ol style="list-style-type: none"> Byte and word data transfer in different addressing Modes Block move (with and without overlap) Block interchange 			
<p>2. Programs involving:</p> <p>Arithmetic & logical operations like:</p> <ol style="list-style-type: none"> Addition and Subtraction of multi precision nos. Multiplication and Division of signed and unsigned Hexadecimal nos. ASCII adjustment instructions. Code conversions. 			
<p>3. Programs involving:</p> <p>Bit manipulation instructions like checking:</p> <ol style="list-style-type: none"> Whether given data is positive or negative Whether given data is odd or even Logical 1's and 0's in a given data 2 out 5 code Bit wise and nibble wise palindrome 			
<p>4. Programs involving:</p> <p>Branch/ Loop instructions like</p> <ol style="list-style-type: none"> Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order. Two application programs using Procedures and Macros (Subroutines). 			

<p>5. Programs involving</p> <p>String manipulation like string transfer, string reversing, searching for a string.</p>
<p>6. Programs involving</p> <p>Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.</p>
<p>7. Interfacing Experiments:</p> <p>Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)</p> <ol style="list-style-type: none"> 1. Matrix keyboard interfacing 2. Seven segment display interface 3. Logical controller interface 4. Stepper motor interface 5. ADC and DAC Interface (8 bit) 6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. • Understand assembler directives, branch, loop operations and DOS 21H Interrupts. • Write and execute 8086 assembly level programs to sort and search elements in a given array. • Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. • Utilize procedures and macros in programming 8086. • Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one question from software and one question from hardware interfacing to be set. • Students are allowed to pick one experiment from the lot. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.



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<u>LINEAR ICS AND COMMUNICATION LAB</u> As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV (EC/TC)			
Laboratory Code	15ECL48	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: <ul style="list-style-type: none"> • Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp. • Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp • Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations. • Design, Demonstrate and Analyze balance modulation and frequency synthesis. • Demonstrate and Analyze pulse sampling and flat top sampling. 			
Laboratory Experiments:			
1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.			
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.			
3. Design active second order Butterworth low pass and high pass filters.			
4. Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.			
5. Design Adder, Integrator and Differentiator using Op-Amp.			
6. Design of Monostable and Astable Multivibrator using 555 Timer.			
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.			
8. Amplitude modulation using transistor/FET (Generation and detection).			
9. Frequency modulation using IC 8038/2206 and demodulation.			
10. Design BJT/FET Mixer.			
11.DSBSC generation using Balance Modulator IC 1496/1596.			
12. Frequency synthesis using PLL.			

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.



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B.E E&C FIFTH SEMESTER SYLLABUS

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 of Management
- Understand the need for Entrepreneurs and their skills
- Understand Project identification and Selection
- Identify the Management functions and Social responsibilities
- Distinguish between management and administration

Module-1	RBT Level
<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).</p> <p>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).</p>	L1, L2
Module-2	
<p>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).</p> <p>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 (Selected topics from Chapters 15 to 18 and 9, Text 1).</p>	L1, L2
Module-3	
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).</p>	L1, L2

<p>Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship (Selected topics from Chapter 2, Text 2).</p>	
Module-4	
<p>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, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only)(Selected topics from Chapter1, Text 2).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics from Chapter 4, Text 2).</p>	L1, L2
Module-5	
<p>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.</p> <p>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.</p> <p>(Selected topics from Chapters 16 to 20 of Unit 3, Text 3).</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of Management and Entrepreneurship • Select a best Entrepreneurship model for the required domain of establishment • Describe the functions of Managers, Entrepreneurs and their social responsibilities • Compare various types of Entrepreneurs • Analyze the Institutional support by various state and central government agencies 	
<p>Question paper pattern</p> <ul style="list-style-type: none"> • The question paper will have TEN questions. • Each full question carries 16 marks. • There will be two full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

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, ISBN 978-81-7758-260-4.
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.



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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 Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

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-2 FFT algorithm for the computation of DFT and IDFT-decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.	L1, L2, 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, L2, L3
Module-5	
Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling	L1, L2,

structure, Lattice structure. 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: <ul style="list-style-type: none"> • Determine response of LTI systems using time domain and DFT techniques. • Compute DFT of real and complex discrete time signals. • Computation of DFT using FFT algorithms and linear filtering approach. • Solve problems on digital filter design and realize using digital computations. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • 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 each module. 	
Text Book: Digital signal processing – Principles Algorithms & Applications , Proakis & Monalakis, Pearson education, 4 th Edition, New Delhi, 2007.	
Reference Books: <ol style="list-style-type: none"> 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. 	




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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: <ul style="list-style-type: none"> • Differentiate between Verilog and VHDL descriptions. • Learn different Verilog HDL and VHDL constructs. • Familiarize the different levels of abstraction in Verilog. • Understand Verilog Tasks and Directives. • Understand timing and delay Simulation. • Learn VHDL at design levels of data flow, behavioral and structural for effective modeling of digital circuits. 			
Module-1			RBT Level
Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text1) Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1)			L1, L2, L3
Module-2			
Basic Concepts Lexical conventions, data types, system tasks, compiler directives. (Text1) Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1)			L1, L2, L3
Module-3			
Gate-Level Modeling 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) Dataflow Modeling Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1)			L1, L2, L3
Module-4			
Behavioral Modeling 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. (Text1)	
Module-5	
Introduction to VHDL Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis, Design tool flow, Font conventions. 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 <ul style="list-style-type: none"> • Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction. • Write simple programs in VHDL in different styles. • Design and verify the functionality of digital circuit/system using test benches. • Identify the suitable Abstraction level for a particular digital design. • Write the programs more effectively using Verilog tasks and directives. • Perform timing and delay Simulation. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • 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 each module 	
Text Books: <ol style="list-style-type: none"> 1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition. 2. Kevin Skahill, "VHDL for Programmable Logic", PHI/Pearson education, 2006. 	
Reference Books: <ol style="list-style-type: none"> 1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition. 2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition. 3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier. 	


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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:

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

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 of Text 1).	L1, L2, L3
Module-2	
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2). Encoding of the Source Output, Shannon's Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1). 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	
Information Channels: Communication Channels (Section 4.4 of Text 1). Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections 4.2, 4.3, 4.4, 4.6, 4.7 of Text 3).	L1, L2, L3
Module-4	

<p>Error Control Coding: 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.</p> <p>Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an $(n-k)$ Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1).</p>	L1, L2, L3
Module-5	
<p>Some Important Cyclic Codes: Golay Codes, BCH Codes(Section 8.4 – Article 5 of Text 2).</p> <p>Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5 – Articles 1,2 and 3, 8.6- Article 1 of Text 2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> • Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source • Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms • Model the continuous and discrete communication channels using input, output and joint probabilities • Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes • Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • 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 each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996. 2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008. 3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007 2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering 	

3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.



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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 Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Understand the services provided by an operating system. • Understand how processes are synchronized and scheduled. • Understand different approaches of memory management and virtual memory management. • Understand the structure and organization of the file system • Understand interprocess communication and deadlock situations. 			
Module-1			RBT Level
Introduction to Operating Systems 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, Time Sharing Systems, Real Time and distributed Operating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).			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 of Text).			L1, L2
Module-3			
Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies (Topics from Sections 5.5 to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1 of Text).			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 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 algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to			L1, L2, L3

11.5 of Text).

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

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of three sub questions) from each module.
- 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 each module

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. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.


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Object Oriented Programming Using C++

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: <ul style="list-style-type: none"> • Define Encapsulation, Inheritance and Polymorphism. • Solve the problem with object oriented approach. • Analyze the problem statement and build object oriented system model. • Describe the characters and behavior of the objects that comprise a system. • Explain function overloading, operator overloading and virtual functions. • Discuss the advantages of object oriented programming over procedure oriented programming. 			
Module -1			RBT Level
Beginning with C++ and its features: 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 Ch -2,3 of Text).			L1, L2
Module -2			
Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual 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 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 operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text).			L1, L2, L3
Module -4			
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance,			L1, L2, L3

Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).	
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: <ul style="list-style-type: none"> • Explain the basics of Object Oriented Programming concepts. • Apply the object initialization and destroy concept using constructors and destructors. • Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. • Use the concept of inheritance to reduce the length of code and evaluate the usefulness. • Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. • Use I/O operations and file streams in programs. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Book: ObjectOriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013. Reference Book: Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.	



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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) + 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

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

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

1. Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).
6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
(ii) DFT computation of square pulse and Sinc function etc.
7. Design and implementation of FIR filter to meet given specifications (using different window techniques).
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

9. Linear convolution of two sequences
10. Circular convolution of two sequences
11. N-point DFT of a given sequence
12. Impulse response of first order and second order system
13. Implementation of FIR filter

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

- Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.

- Modelling of discrete time signals and systems and verification of its properties and results.
- Implementation of discrete computations using DSP processor and verify the results.
- Realize the digital filters using a simulation tool and a DSP processor and verify the frequency and phase response.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.


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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	01 Hr 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:

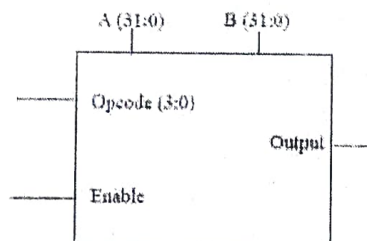
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesise the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

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 analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

Part-A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer.
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
3. Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Write a Verilog code to model 32 bit ALU using the schematic diagram shown below



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

- ALU should decode the 4 bit op-code according to the example given below.

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. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
6. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and "any sequence" counters, using Verilog code.

Part-B: INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
3. Write HDL code to control speed, direction of DC and Stepper motor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.
6. Write HDL code to simulate Elevator operation.

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

- Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

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B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION

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

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

Subject Code	15EC61	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 the course is to enable students to:

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


Module-1	RBT Level
<p>Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p>Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2)</p>	L1, L2, L3
Module-2	
<p>Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4).</p>	L1, L2, L3
Module-3	
<p>Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM (Relevant topics in Text 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK</p>	

<p>generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12, 7.13).</p>	
Module-4	
<p>Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI-The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol-by-Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2).</p> <p>Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).</p>	L1, L2, L3
Module-5	
<p>Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Associate and apply the concepts of Bandpass sampling to well specified signals and channels. • Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. • Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. • Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module 	
<p>Text Books:</p>	

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books:

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.


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ARM MICROCONTROLLER & EMBEDDED SYSTEMS

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

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

<u>ARM MICROCONTROLLER & EMBEDDED SYSTEMS</u> B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC62	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: <ul style="list-style-type: none">• Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.• Program ARM Cortex M3 using the various instructions and C language for different applications.• Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.• Develop the hardware software co-design and firmware design approaches.• Explain the need of real time operating system for embedded system applications.			
Module-1			
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) L1, L2			
Module-2			
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) L1, L2, L3			
Module-3			
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. (Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). L1, L2, L3			
Module-4			
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded			

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).

(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques

(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2, 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

L1, L2, L3

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

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.



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

Subject Code	15EC63	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 the course is to enable students to: <ul style="list-style-type: none"> • Impart knowledge of MOS transistor theory and CMOS technologies • Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology • Cultivate the concepts of subsystem design processes • Demonstrate the concepts of CMOS testing 			
Module-1			RBT Level
Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2). Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).			L1, L2
Module-2			
MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout. Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).			L1, L2, L3
Module-3			
Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).			L1, L2, L3
Module-4			
Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1). FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture, Physical design for FPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3).			L1, L2, L3
Module-5			
Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).			L1, L2, L3

Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).	
Course outcomes: At the end of the course, the students will be able to: <ul style="list-style-type: none"> • Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling. • Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects. • Interpret Memory elements along with timing considerations • Demonstrate knowledge of FPGA based system design • Interpret testing and testability issues in VLSI Design • Analyze CMOS subsystems and architectural issues with the design constraints. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module 	
Text Books: <ol style="list-style-type: none"> 1. “Basic VLSI Design”- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994). 2. “CMOS VLSI Design- A Circuits and Systems Perspective”- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education. 3. “FPGA Based System Design”- Wayne Wolf, Pearson Education, 2004, Technology and Engineering. 	



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Dept. Of Electronics & Communication
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DIGITAL SYSTEM DESIGN USING VERILOG

B.E., VI Semester (Open Elective)

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

Subject Code:	15EC663	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: <ul style="list-style-type: none"> • Understand the concepts of Verilog Language. • Design the digital systems as an activity in a larger systems design context. • Study the design and operation of semiconductor memories frequently used in application specific digital system. • Inspect how effectively IC's are embedded in package and assembled in PCB's for different application. • Design and diagnosis of processors and I/O controllers used in embedded systems. 		
Module -1		RBT Level
Introduction and Methodology: Digital Systems and Embedded Systems, Real-World Circuits, Models, Design Methodology (1.1, 1.3 to 1.5 of Text). Combinational Basics: Combinational Components and Circuits, Verification of Combinational Circuits. (2.3 and 2.4 of Text) Sequential Basics: Sequential Datapaths and Control Clocked Synchronous Timing Methodology (4.3 up to 4.3.1, 4.4 up to 4.4.1 of Text).		L1, L2, L3
Module -2		
Memories: Concepts, Memory Types, Error Detection and Correction (Chap 5 of Text).		L1, L2, L3
Module -3		
Implementation Fabrics: Integrated Circuits, Programmable Logic Devices, Packaging and Circuit boards, Interconnection and Signal integrity (Chap 6 of Text).		L1, L2, L3
Module -4		
I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software (Chap 8 of Text).		L1, L2, L3
Module -5		
Design Methodology: Design flow, Design optimization, Design for test, Nontechnical Issues (Chap 10 of Text).		L1, L2, L3, L4
Course outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Construct the combinational circuits, using discrete gates and programmable logic devices. • Describe Verilog model for sequential circuits and test pattern generation. • Design a semiconductor memory for specific chip design. 		

- Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
- Synthesize different types of processor and I/O controllers that are used in embedded system.

Question paper pattern:

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

Text Book:

Peter J. Ashenden, "Digital Design: An Embedded Systems Approach Using VERILOG", Elsevier, 2010.


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EMBEDDED CONTROLLER LAB

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

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

Subject Code	15ECL67	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:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

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

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

Conduction of Practical Examination:

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.



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B.E E&C SEVENTH SEMESTER SYLLABUS

MICROWAVES AND ANTENNAS

B.E., VII Semester, Electronics & Communication Engineering
[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 Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none">• Describe the microwave properties and its transmission media• Describe microwave devices for several applications• Understand the basics of antenna theory• Select antennas for specific applications			
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, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub 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			
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, 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, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (Text 3: 5.1 – 5.10, 5.13)

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)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular 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)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of 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:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4th Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.



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Dept. Of Electronics & Communication
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DIGITAL IMAGE PROCESSING

B.E., VII Semester, Electronics & Communication Engineering
[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: <ul style="list-style-type: none"> • Understand the fundamentals of digital image processing • Understand the image transform used in digital image processing • Understand the image enhancement techniques used in digital image processing • Understand the image restoration techniques and methods used in digital image processing • Understand the Morphological Operations and Segmentation used in digital image processing 			
Module-1			RBT Level
Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, 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 Nonlinear Operations. [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 Frequency Domain: 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. [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 Squares Filtering. [Text: Chapter 5: Sections 5.2, to 5.9]			L1, L2, L3
Module-4			

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. [Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, 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. Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2]	L1, L2, L3
Course Outcomes: At the end of the course students should be able to: <ul style="list-style-type: none"> • Understand image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of Image Enhancement techniques. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Book: Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.	
Reference Books: <ol style="list-style-type: none"> 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004. 	



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POWER ELECTRONICS

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

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

POWER ELECTRONICS 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: <ul style="list-style-type: none">• Understand the construction and working of various power devices.• Study and analysis of thyristor circuits with different triggering conditions.• Learn the applications of power devices in controlled rectifiers, converters and inverters.• Study of power electronics circuits under various load conditions.			
Module-1			
Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer 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 transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) L1, L2, L3			
Module-3			
Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, 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 of Phase 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 able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 05 marks out of 20 Internal Assessment (IA) Marks, reserved for the other activities.

Text Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

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 Lecture Hours	40 (08 Hours / Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
- Understand digitization principle techniques required to analyze different media types.
- Analyze compression techniques required to compress text and image and gain knowledge of DMS.
- Analyze compression techniques required to compress audio and video.
- Gain fundamental knowledge about multimedia communication across different networks.

R. V. S.

DSP Algorithms and Architecture
B.E., VII Semester, Electronics & Communication Engineering
/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: <ul style="list-style-type: none"> • Figure out the knowledge and concepts of digital signal processing techniques. • Understand the computational building blocks of DSP processors and its speed issues. • Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor. • Learn how to interface the external devices to TMS320C54xx processor in various modes. • Understand basic DSP algorithms with their implementation. 			
Module-1			RBT Level
Introduction to Digital Signal Processing: Introduction, A Digital Signal – Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.			L1, L2
Computational Accuracy in DSP Implementations: Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation.			
Module-2			
Architectures for Programmable Digital Signal – Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.			L1, L2, L3
Module-3			
Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54XX, Memory Space of TMS320C54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On – Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.			L1, L2, L3
Module-4			

Implementation of Basic DSP Algorithms: Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS320C54xx.	L1, L2, L3
Module-5	
Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: 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). Interfacing and Applications of DSP Processors: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.	L1, L2, L3
Course Outcomes: At the end of this course, students would be able to <ul style="list-style-type: none"> • Comprehend the knowledge and concepts of digital signal processing techniques. • Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor. • Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. • Develop basic DSP algorithms using DSP processors. • Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device. • Demonstrate the programming of CODEC interfacing. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of Three sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: "Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.	
Reference Books: <ol style="list-style-type: none"> 1. "Digital Signal Processing: A practical approach", Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002. 2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd, 2010 3. "Architectures for Digital Signal Processing", Peter Pirsch John Wiley, 2008 	

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ADVANCED COMMUNICATION LAB

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

[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 modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Model an optical communication system and study its characteristics.
- Simulate the digital communication concepts and compute and display various parameters along with plots/figures.

Laboratory Experiments

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

1. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
2. ASK generation and detection
3. FSK generation and detection
4. PSK generation and detection
5. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
6. Measurement of directivity and gain of microstrip dipole and Yagi antennas.
7. Determination of
 - a. Coupling and isolation characteristics of microstrip directional coupler.
 - b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
 - c. Power division and isolation of microstrip power divider.
8. Measurement of propagation loss, bending loss and numerical aperture of an optical fiber.

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 polar signaling.
2. Simulate the Pulse code modulation and demodulation system and display the waveforms.
3. Simulate the QPSK transmitter and receiver. Plot the signals and its constellation diagram.
4. Test the performance of a binary differential phase shift keying system by simulating the non-coherent detection of binary DPSK.

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

- Determine the characteristics and response of microwave devices and optical waveguide.
- Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
- Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
- Design and test the digital modulation circuits/systems and display the waveforms.

Conduct of Practical Examination:

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B** or only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.


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ADVANCED COMMUNICATION LAB

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

[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 modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Model an optical communication system and study its characteristics.
- Simulate the digital communication concepts and compute and display various parameters along with plots/figures.

Laboratory Experiments

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

1. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
2. ASK generation and detection
3. FSK generation and detection
4. PSK generation and detection
5. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
6. Measurement of directivity and gain of microstrip dipole and Yagi antennas.
7. Determination of
 - a. Coupling and isolation characteristics of microstrip directional coupler.
 - b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
 - c. Power division and isolation of microstrip power divider.
8. Measurement of propagation loss, bending loss and numerical aperture of an optical fiber.

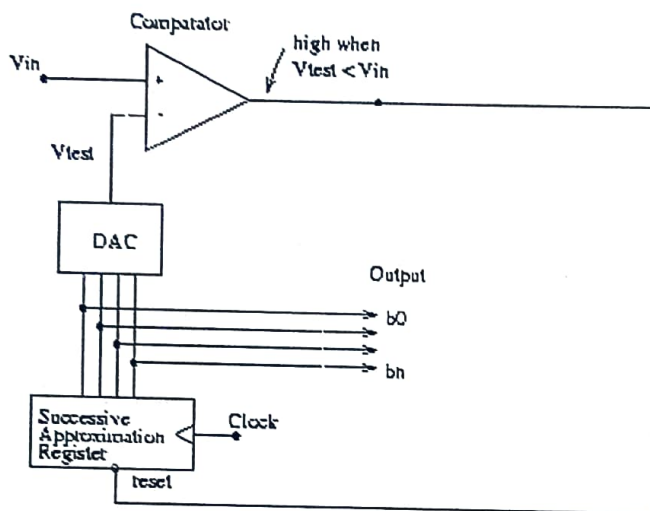
VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

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: <ul style="list-style-type: none"> • Explore the CAD tool and understand the flow of the Full Custom IC design cycle. • Learn DRC, LVS and Parasitic Extraction of the various designs. • Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts. • Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts. 			
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. <ol style="list-style-type: none"> An inverter A Buffer Transmission Gate Basic/universal gates Flip flop -RS, D, JK, MS, T Serial & Parallel adder 4-bit counter [Synchronous and Asynchronous counter] 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 the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - 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 be given.
- ** Appropriate specification should be given.
- *** Applicable Library should be added & information should be given to the Designer.

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

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

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B.E E&C EIGHTH SEMESTER SYLLABUS

Wireless Cellular and LTE 4G Broadband **B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering** [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC81	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none">• Understand the basics of LTE standardization phases and specifications.• Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles.• Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.• Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.			
Module – 1			RBT Level
Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).			L1, L2
Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 – 2.7 of Text).			
Module – 2			
Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 – 3.6 of Text).			L1, L2
OFDMA and SC-FDMA: OFDM with FDMA, TDMA, CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 – 4.3, 4.5 of Text).			
Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 – 5.6 of Text).			
Module – 3			
Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink			L1, L2

SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).	
Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text).	
Module – 4	
Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text). Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text).	L1, L2
Module – 5	
Radio Resource Management and Mobility Management: PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination(Sec 10.1 – 10.5 of Text).	L1, L2
Course Outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> • Understand the system architecture and the functional standard specified in LTE 4G. • Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. • Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. • Test and Evaluate the Performance of resource management and packet data processing and transport algorithms. 	
Question Paper pattern: <ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • 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 each module. 	
Text Book:	
Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.	

Reference Books:

1. 'LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
3. 'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.



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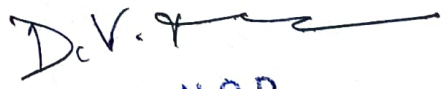
NETWORK AND CYBER SECURITY

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

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

Subject Code	15EC835	IA Marks	20
Number of Lecture 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: <ul style="list-style-type: none">• Know about security concerns in Email and Internet Protocol.• Understand cyber security concepts.• List the problems that can arise in cyber security.• Discuss the various cyber security frame work.			
Module-1			RBT Level
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) (Text 1: Chapter 15)			L1, L2
Module-2			
E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail (Text 1: Chapter 17)			L1, L2
Module-3			
IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites(Text 1: Chapter 18)			L1, L2
Module-4			
Cyber network security concepts: Security Architecture, antipattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy based malware detection. The problems: cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog (Text-2: Chapter1 & 2)			L1, L2, L3
Module-5			
Cyber network security concepts contd. : Enterprise security using Zachman framework Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. Case study: cyber security hands on – managing administrations			L1, L2, L3

and root accounts, installing hardware, reimaging OS, installing system protection/ antimalware, configuring firewalls (Text-2: Chapter 3 & 4).	
Course Outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Explain network security protocols • Understand the basic concepts of cyber security • Discuss the cyber security problems • Explain Enterprise Security Framework • Apply concept of cyber security framework in computer system administration 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of Three sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Books: <ol style="list-style-type: none"> 1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3. 2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley. 	
Reference Books: <ol style="list-style-type: none"> 1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007. 2. Cryptography and Network Security, Atul Kahate, TMH, 2003. 	


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