Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E TELECOMMUNICATION ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA31	Transform calculus and boundary value problems	Mathematics	2	2	--	03	50	50	100	3
2	PC	18TE31	Electronic Devices & Circuits		4	0	--	03	50	50	100	4
3	PC	18TE32	Digital Systems Design		4	0	--	03	50	50	100	4
4	PC	18TE33	Network Theory		4	0	--	03	50	50	100	4
5	PC	18TE34	Linear Integrated Circuits		3	0	--	03	50	50	100	3
6	PC	18TE35	Field Theory		2	2	--	03	50	50	100	3
7	PC	18TEL36	Electronic Devices & Circuits Lab		--	--	3	03	50	50	100	1
8	PC	18TEL37	Digital Systems Design Lab		--	--	3	03	50	50	100	1
9	HS	18HS31/32	Constitution of India Professional Ethics and Human Rights/ / Env. Studies	Hu/Civ	1	--	--	02	50	50	100	1
10	MC	18HS33	Soft skills (MC)	Humanities	04		--	03	50	-	50	0
				TOTAL	**24**	**04**	**06**	**29**	**500**	**450**	**950**	**24**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

11	MC	18MAD31	Advance Mathematics - I	Mathematics	02	01	--	03	50		50	0

Note: HODs are informed to accommodate one more laboratory in addition to the above courses if needed, without altering the total number of credits (TOTAL: 24).

(a)**The mandatory non – credit courses** Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

(b) **The mandatory non – credit courses** Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

Note: BC: Science Course, PC: Professional Core. Hu: Humanities, MC: Mandatory Course.

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E TELECOMMUNICATION ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA41	Numerical Methods and Statistical Techniques	Mathematics	2	2	--	03	50	50	100	3
2	PC	18TE41	Microcontroller using Assembly and C language		4	0	--	03	50	50	100	4
3	PC	18TE42	Fundamentals of Telecommunications		3	0	--	03	50	50	100	3
4	PC	18TE43	Signals & Systems		4	0	--	03	50	50	100	4
5	PC	18TE44	Fundamentals of Hardware Description Language		3	0	--	03	50	50	100	3
6	PC	18TE45	Transmission Lines & Wave guides		4	0	--	03	50	50	100	4
7	PC	18TEL46	Microcontroller Lab		--		3	03	50	50	100	1
8	PC	18TEL47	Programming in HDL Lab		--		3	03	50	50	100	1
9	HS	18HS41/42	Constitution of India Professional Ethics and Human Rights/ Env. Studies	Hum/Civ	1	--	--	02	50	50	100	1
10	MC	18HS43	Employability skills (MC)	Humanities	04		--	03	50	-	50	0
				TOTAL	**25**	**02**	**06**	**29**	**500**	**450**	**950**	**24**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
11	MC	18MAD41	Advance Mathematics - II	Mathematics	02	01	--	03	50		50	0

Note: HODs are informed to accommodate one more laboratory in addition to the above courses if needed, without altering the total number of credits (TOTAL: 24).

(a) The mandatory non – credit courses Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entrant Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

(b) The mandatory non – credit courses Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

Note: BC: Science Course, PC: Professional Core. Hu: Humanities, MC: Mandatory Course.
ENV: Environmental Studies, CIP: Constitution of India Professional Ethics and Human Rights

Sub Title : ELECTRONICS DEVICES AND CIRCUITS		
Sub Code:18TE31	**No. of Credits: 4=4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

Course objectives:

1. To become familiar with the different electronic devices, and analysis of different diode circuits.
2. To understand the DC analysis of BJT circuits.
3. To study the concept of different power amplifiers circuits.
4. To understand different feedback techniques used in electronic circuits and concept of oscillators.
5. To analyse different FET circuits.

UNIT No	Syllabus Content	No. of Teaching Hours
1	**Diode Circuits:** Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers, Voltage Multipliers- relevant problems. **(Text 1)**	10
2	**Transistor Biasing:** Operating point, Fixed bias circuits, Emitter bias , Voltage divider bias, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization - relevant problems. **(Text 1)**	8
3	**Fabrication of pn junction** Thermal oxidation, Diffusion,Rapid thermal processing Ion implantation,chemical vapour deposition,photo lithography,etching,metallization **(Text 3 ,5.1)** **Power Amplifiers:** Introduction, series fed class A amplifier, Transformer coupled class A amplifier, class B amplifier operations, class B amplifier circuits, amplifier distortions, power transistor heat sinking, class C and class D amplifiers - relevant problems. **(Text 1)**	12
4	**(a) Feedback Amplifier:** Feedback concept, Feedback connections type, Practical feedback circuits **(b) Oscillators:** Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal	10

	Oscillator. (BJT Version Only) - relevant problems**.** **(Text 1)**	
5	**Field Effect Transistor :** n-channel JFET , p-channel JFET, JFET characteristics, FET amplification and switching, FET Oscillators, FET biasing – DC load line bias point, Effect of source resistor, gate bias, self-bias, voltage divider bias - relevant problems, introduction to MOSFET, Enhancement & Depletion MOSFETs, VMOS. **(Text 2)**	12

Note :

1. Unit 1 is identified for blended learning

2. Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

CO1: Analyze different electronic circuits using diodes, transistors and FET.
CO2: Designing various transistors dc bias circuit .
CO3: Create different diode, BJT and FET circuits.
CO4: Remember different feedback techniques used in oscillators and amplifiers.
CO5: Understand the concept of amplifiers and oscillators.

Cos	Mapping with POs
CO1	PO1,PO2,PO5,PO6,PO10
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO4,PO5,PO6
CO4	PO1,PO2,PO3
CO5	PO2,PO5,PO6,PO9

TEXT BOOK:

1. **"Electronic Devices and Circuit Theory",** Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 10th Edition , Publication year 2009.
2. **"Electronic Devices and Circuits",** David A. Bell, PHI/Oxford University Press, 5th Edition, Publication year 2008.
3. **"Solid State Electronic Devices"** by Ben G Streetman,Sanjay.K.Banergee,7th Edn, Pearson Education,2016.

REFERENCE BOOKS/WEBLINKS :

1. **"Millman's Electronic Devices and Circuits" ,** Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata - McGraw Hill Publication, 3rd Edition, 2010.
2. "**Analog Circuits: A Fundamental Approach"**, U.B. Mahadevaswamy, Pearson/Saguine, Publication year 2007.
3. "**Electronic Principles**", David Bates, Albert Malvino, McGraw Hill Publications, 7th edition, Publication year 2006.
4. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-301-solid-state-circuits-fall-2010/download-course-materials/

Sub Title : DIGITAL SYSTEM DESIGN		
Sub Code:18TE32	**No. of Credits: 4 = 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours :52**

Course Objectives:

1. To learn the methods of simplifying the digital circuits.
2. To design combinational circuits like arithmetic circuits, code converters, multiplexers and de-multiplexers.
3. To design and analyse sequential circuits such as registers and counters using flip-flops.
4. To design and analyse digital circuits using Mealy and Moore models.
5. To apply combinational and sequential circuits in the design of digital systems.

UNIT No.	Syllabus Content	No. of Teaching Hours
1.	**Principles of combinational logic:** Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3 and 4 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 Implicant Tables, Map entered variables.	**12**
2.	**Design of combinational logic:** General approach, Decoders-BCD decoders, Encoders. Digital multiplexers - Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry adder, Binary comparators.	**10**

3.	**Sequential Circuits-I:** Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The $\bar{S}\bar{R}$ Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, the Master-Slave JK Flip- Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop.	**10**
4.	**Sequential Circuits-II:** Characteristic Equations of flip-flops, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops.	**10**
5.	**Sequential Design:** Introduction, Mealy and Moore Models, State Machine notation, Synchronous Sequential Circuit Analysis and Design. Construction of state Diagrams, Counter Design, introduction to Programmable logic devices.	**10**

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

CO1: Learnt the simplification of Boolean expressions and realize with minimum logic gates.
CO2: Analyse the given digital circuits.
CO3: Design various types of combinational and sequential circuits.
CO4: Realise higher order digital circuits using lower order digital circuits.
CO5: Apply combinational and sequential circuits in the design of digital systems.

COs	Mapping with Pos
CO1	PO1, PO2, PO7, PO10
CO2	PO2, PO3, PO4, PO8
CO3	PO3, PO4, PO7
CO4	PO3, PO4, PO9
CO5	PO5, PO6, PO9

TEXT BOOKS:

1. "**Digital Logic Applications and Design**", John M Yarbrough, Cengage Delmar Learning India Pvt, 2015.
2. "**Digital Principles and Design**", Donald D. Givone, Tata McGraw Hill, 1st Edition, 2007.

REFERENCE BOOKS/WEBLINKS:

1. "**Fundamentals of logic design**", Charles H Roth, Larry N. Kinney, Cengage Learning, 7th Ed., 2014.
2. "**Logic and computer design Fundamentals**", M. Morris Mono and Charles R. Kime, Pearson Publishers, 4th Edition, 2007.

Sub Title : NETWORK THEORY		
Sub Code: 18TE33	**No. of Credits: 4=4:0:0 (L:T:P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

3. http://elearning.vtu.ac.in/elcmys/CS33.html

Course Objectives :

1. To learn about the basic laws of electric circuits as well as the key fundamentals of the communication channels, namely transmission lines.
2. To understand the need of simplification techniques of complicated circuits using network theorems.
3. To learn about the comprehensive insight into the principle techniques available for characterizing Resonance circuits, networks and their evaluation of initial and final conditions and implementation in practice.
4. To learn applications of Laplace transforms in network applications
5. To gain knowledge of two-port network parameters modelling and their implementation.

UNIT No.	Syllabus Content	No. of Teaching Hours
1	**Basic Concepts:** Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and Node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super Node and super Mesh, relevant problems.	12
2	**Network Theorems:** Superposition, Reciprocity and Millman's theorem, Thevinin's and Norton's theorems; Maximum Power transfer theorem, relevant problems.	10
3	**Resonant Circuits:** Series and parallel resonance, frequency response of series and parallel circuits, Q-factor, Bandwidth relevant problems.	10

4	**Transient behavior and initial conditions :** Behaviors of circuit elements under switching condition and their Representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations, relevant problems.	10
5.	**Laplace Transformation :** Solution of networks, step, ramp and impulse responses, waveform Synthesis, definition of transfer function, relevant problems **Two port network parameters :** Definition of z, y, h and transmission parameters , modeling with these parameters, relationship between parameters sets, relevant problems .	10

Note : **1.** In Unit 5, is identified for blended learning.

2. Students submit three assignments covering five units with higher level questions upto level.

Course Outcomes :

CO1:State and understand various Network theorems.
CO2: Understand basic concepts of Network Reduction techniques.
CO3: Apply knowledge of mathematics to solve and understand Network theorems related to network, initial conditions, Laplace Transformations, Two port network parameters
CO4: Analyse networks in terms of different two port network parameters.
CO5: Evaluate the transient behaviour of different networks, and quality factor of resonant circuits.

COs	**Mapping with POs**
CO1	PO1,PO2,PO4
CO2	PO2,PO4
CO3	PO1,PO2,PO3,PO4,PO5
CO4	PO1,PO4
CO5	PO1,PO4

TEXT BOOKS:

1. "**Network Analysis**", M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. "**Networks and systems**", Roy Choudhury,2nd edition,2009, New Academic Science Ltd.

REFERENCE BOOKS/WEBLINKS :

1."**Basic Circuit Analysis**" by John O'Maley, 2nd Edition, Schaum's Outlines,2011.

2."**Engineering Circuit Analysis**", Hayt, Kemmerly and Durbin, 8th Edition, TMH, 2013.

3. elearning.vtu.ac.in/06ES34.html

Sub Title : LINEAR INTEGRATED CIRCUITS		
Sub Code: 18TE34	**No. of Credits : 3=3:0:0(L:T:P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives :

1. To Learn basic concepts of Op Amp, Parameters, Opamps as DC Amplifiers, Opamp as Inverting, Non Inverting, Summing, Difference Circuits.
2. To design Op-Amps as AC Amplifiers, High Z_{in} Capacitor Coupled Voltage Follower, Inverting, Non Inverting Op Amp.
3. To understand Op-Amps frequency response and compensation**.**
4. To understand and design waveform generation circuits, and understand various linear applications of Op-amp.
5. To understand various Non-linear applications of Op-amp and 555 Timer.

UNIT No.	Syllabus Content	No. of Teaching Hours
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, Difference amplifier. **(Text 1)**	**08**

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. **(Text 1)**	**08**
3	**Op-Amps frequency response and compensation:** Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions. **(Text 1)**	**07**
4	**Op-Amp Applications:** Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, Integrator, Comparator,sample and hold circuits, V to I and I to V converters, phase shift oscillator, Wein bridge oscillator . **(Text 1)**	**08**
5.	**Non-linear circuit applications:** Crossing detectors, inverting Schmitt trigger circuits, Active Filters –First and second order Low pass and High pass filters. **Other Linear IC applications:** 555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger,Square Wave Generator, PLL-operating principles, VCO. **(Text 1)**	**08**

Note :

- Unit 5 is identified for blended learning.
- Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

CO1: Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate.

CO2: Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower.

CO3: Design Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers, linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider.

CO4: Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps.

CO5: Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

Cos	**Mapping with Pos**

CO1	PO1,PO2,
CO2	PO1, PO3,
CO3	PO1,PO2
CO4	PO2, PO5,PO9
CO5	PO2

TEXT BOOKS:

1**. "Operational Amplifiers and Linear IC's"** , David A. Bell, 3rd edition. Oxford University Press, 2011.

2. **"Linear Integrated circuits"**, D. Roy Choudhary and Shail B. Jain, 3rd edition, New Academic Science Ltd. 2010.

REFERENCE BOOKS/WEBLINKS:

1**."Op - Amps and Linear Integrated Circuits"**, James M. Fiore, Thomson Learning, 2001.

2**."Design with Operational Amplifiers and Analog Integrated Circuits"**, Sergio Franco,TMH, 3rd edition,2005.

3. "Op Amps and Linear Integrated circuits", Ramakant .A. Gayakwad, 4th edition, PHI,2009.

Subject Title : FIELD THEORY		
Sub Code: 18TE35	**No. of Credits:3 = 2:2:0 (L:T:P)**	**No. of hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

Course objectives :

1. To introduce the fundamental principles of static electric fields.
2. To understand the concepts of energy and potential.
3. To study Laplace's equations and Poisson's equations and its applications.
4. To introduce the principles of time-varying magnetic field.
5. To learn the use of time-varying Maxwell's equations for analyzing wave propagation.

UNIT No.	**Syllabus Content**	**No. of Hours**	
		Teaching	**Tutorials**

1	**a. Coulomb's Law and electric field intensity**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge **,** relevant problems **b**. **Electric flux density, Gauss' law and divergence:** Electric flux density, Gauss' law, Application of Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator ∇ and divergence theorem, relevant problems	06	06
2	**Energy and potential and Conductors :** Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential diff erence and Potential, The potential field of a point charge and system of charges, Potential gradient , Current and current density, Continuity of current, relevant problems.	05	05
3	**Poisson's and Laplace's equations:** Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, relevant problems **Boundary conditions :** metallic conductors, Conductor properties and boundary conditions between conductor and dielectric material ,boundary conditions for perfect Dielectrics,	05	05
4	**The steady magnetic field:** Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials, Relevant problems**.** **Time Varying Maxwell's equations**: Faraday's Law, Displacement current, Equation of Continuity.	05	05
5	**Uniform Plane wave :** Wave equations**,** Wave Propagation in free space and dielectrics, Poynting's theorem and power, Propagation in good conductors – Skin Effect, Depth of penetration ,Normal incidence at dielectric-dielectric interface, Normal incidence at conductor-dielectric interface, relevant problems	05	05

Note:

3. In Unit 5, Wave propagation in free space is identified for blended learning.
4. Students submit three assignments covering five units with higher level questions upto level.

Course Outcomes :

CO1 Explain the concepts of energy expended in moving a charge, potential gradient, vector magnetic potential, wave propagation in free space.
CO2: Remember Coulomb's law, Gauss's law, Ampere's law, Biot-Savart's law.
CO3: Evaluate the value of potential, Laplace's and Poisson's equations.
CO4: Apply knowledge of Maxwell's equations for interpretation of uniform plane wave.
CO5: Analyze the variations in EM waves at interface between two media.

COs	Mapping with Pos
CO1	PO1, PO2, PO10
CO2	PO1, PO2
CO3	PO1, PO2
CO4	PO1, PO2
CO5	PO1, PO2

TEXT BOOKS:

1. **"Engineering Electromagnetics",** William H Hayt Jr. and John A Buck**,** Tata McGraw- Hill, 8th edition, 2012
2. **"Electromagnetic Waves And Radiating Systems,"** Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002

REFERENCE BOOKS/WEBLINKS:

1. **"Electromagnetics",** Joseph A.Edminister, Mahmod Nahvi, Schaum Outline series, McGraw Hill,4th edition,2013
2. **"Fundamentals of Electromagnetics with MATLAB",** Karl Erik Lonngren, Sava Vasilev Savov, Randy J. Jost, SciTech Publication, 2nd edition,2007.
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009/lecture-notes/

Sub Title : EDC LAB		
Sub Code: 18TEL36	**No. of Credits : 1= 0: 0 : 3 (L:T:P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 =100**	

Course Outcomes :
CO1: Design and analysis amplifier circuits using transistors. CO2: Design of different transistor oscillators. CO3: Design and analysis of various clipping and clamping circuits. CO4: Design and analysis of various rectifier circuits. CO5: Analysis of different parameters of FET.
Course Objectives: 1. Design and working of transistor amplifiers. 2. Design and verification of Transistor Oscillators. 3. Design and verification of diode circuits and applications. 4. Analysis of FET characteristics. 5. Introduction to MULTISIM.

1. Design and testing of Diode clipping circuits
2. Design and testing of Clamping circuits.
3. Design and testing of RC coupled Single stage BJT amplifier . Determination of the gain-frequency response, input and output impedances.
4. Design and testing of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit).
5. Design and testing of BJT-RC Phase shift Oscillator for $f_0 \leq 10$ KHz.
6. Design and testing of BJT – Colpitt's Oscillators for RF range $f_0 \geq 100$KHz.
7. Design and testing of BJT -Crystal Oscillator for $f_0 > 100$ KHz
8. Characteristics of FET.
9. Design and testing of half wave Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.
10. Design and testing of fullwave Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.

Study Experiments using MULTISIM :

1. RC coupled amplifier
2. Colpitts Oscillator

Cos	Mapping with Pos
CO1	PO1,PO 2, PO4, PO10
CO2	PO1, PO2, PO3, PO8
CO3	PO1, PO2, PO3, PO4, PO7
CO4	PO1, PO2, PO3, PO4, PO9
CO5	PO1, PO2, PO3, PO5, PO6, PO9

Sub. Title : DIGITAL SYSTEM DESIGN LAB		
Sub Code: 18TEL37	**No. of Credits: 1 = 0 : 0 : 3 (L:T:P)**	**No. of lecture hours/week :3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 =100**	

Course Objectives:

1. To design digital circuit for given Boolean expressions using logic gates.
2. To verify the design of arithmetic circuits using logic gates and ICs.
3. To test different code-conversion circuits.
4. Applications of Multiplexer and De-multiplexers for implementation of different logic circuits.
5. To test comparator and priority encoder circuits.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3. Realization of parallel adder/Subtractors using 7483 chip.
4. BCD to Excess-3 code conversion and vice versa.
5. Realization of Binary to Gray code conversion and vice versa
6. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.

7. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
8. Use of a) Decoder chip to drive LED display and b) Priority encoder.
9. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
10. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).
11. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
12. Wiring and testing Ring counter/Johnson counter.

Demonstration Experiment:

1. Verification of Truth table of full adder and one bit comparator using MULTISIM simulator.

Course Outcomes :
CO1: Design simplified combinational circuits.
CO2: Design adders and subtractors.
CO3: Design and analyze multiplexer and code converters.
CO4: Design and analyze comparators.
CO5: Design different flip-flops and verification of the same.

Cos	**Mapping with POs**
CO1	PO1,PO 2, PO7, PO10
CO2	PO1, PO2, PO3, PO4, PO8
CO3	PO1, PO2, PO3, PO 4, PO 7
CO4	PO1, PO2, PO3, PO4, PO9
CO5	PO1, PO2, PO3, PO5, PO6, PO9

Sub Title : MICROCONTROLLER USING ASSEMBLY AND C LANGUAGE		
Sub Code: 18TE41	**No. of Credits:4= 4:0:0 (L:T:P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hrs	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives :

1. To understand the architecture of Microprocessor & Microcontroller and other related architectures.
2. To learn memory organization of 8051 architecture, basic programming for Intel 8051 Microcontroller using Assembly language.
3. To learn the basic embedded C language for Intel 8051microcontroller and study programming using Assembly & Embedded C language for timers/counters.
4. To study the serial communication & interrupts in 8051 microcontroller.
5. To study the on-chip peripherals and interfacing programs for Microcontroller in assembly and C language.

Unit No.	Syllabus Content	No. of Teaching Hours
1.	**Introduction:** A Historical background, the microprocessor based Personal Computer System. Architecture of 8086: Internal Microprocessor architecture, Real Mode Memory addressing. Introduction to 80386, 80486 & Pentium Processors. Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software. (Text 1 & Reference 1)	10
2.	**The 8051 Architecture:** Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks. **Instruction set:** Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.	10

	Instruction syntax, **Addressing modes:** Immediate addressing, Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. (Text 2)	
3.	**8051 programming in C:** Introduction to Embedded C**,** data types,Programming using Embedde C, logic operation, data conversion programs accessing code ROM space. Time delay calculations in 8051C. I/O programming. **Timers/counters:** Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C . (Text 2)	**12**
4.	**8051 Serial Communication:** Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in C. (Text 2) **Interrupts:** Basics of interrupts, 8051 interrupt structure (Text 2)	**11**
5.	**On-chip peripherals:** Watchdog Timer, Comparator, Real Time Clock (RTC), ADC, DAC, LCD, keyboard, stepper motor interfacing. (Text 2) (Blended Learning)	**09**

NOTE:

1. Unit 5 **On-chip peripherals** is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course outcomes:

CO1: Explain the different architectures of Microprocessors and Microcontrollers, RISC and CISC, and Harvard and Von Neumann.
CO2: Apply the knowledge of instruction sets and various addressing modes for programming for Intel 8051 Microcontroller using assembly language.
CO3: Design Timers/counters using programming Intel 8051 Microcontroller using assembly and C language.
CO4: Analyze of 8051 serial communication & interrupts, using both assembly and C languages.
CO5: Demonstrate interfacing programs for 8051 Microcontroller in assembly and C language.

COs	**Mapping with Pos**
CO1	PO1,PO 2,PO7, PO10
CO2	PO1,PO 2,PO3, PO4, PO8
CO3	PO1,PO2, PO3, PO4, PO7
CO4	PO1,PO2, PO3, PO4, PO9

CO5	PO1,PO 2, PO3, PO5,PO6, PO9

TEXT BOOKS:

1. **The Intel Microprocessors, Architecture, Programming and Interfacing –** Barry B. Brey, 8e, Pearson Education / Phi, 2009.
2. **"The 8051 Microcontroller and Embedded Systems – using assembly and C",** Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, Pearson, 2006.

REFERENCE BOOKS/WEBLINKS:

1. **"The 8051 Microcontroller Architecture, Programming and Applications",** 2e Kenneth J. Ayala, Thomson Learning 2005.
2. **Microcontrollers: Architecture, Programming, Interfacing and System Design",**Raj Kamal, " Pearson Education, 2005.
3. http://elearning.vtu.ac.in/elcmys/06ES42.html
4. "**The 8051 Microcontroller**", V.Udayashankar and MalikarjunaSwamy, TMH,2009.

Sub Title :FUNDAMENTALS OF TELECOMMUNICATIONS		
Sub Code: 18TE42	**No of Credits: 3=3:0:0 (L-T-P)**	**No of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No of Contact Hours : 39**

Course Objectives:

1. Understanding basic terms and principles of signal processing in telecommunication transmission.
2. Describing basic principles of the modern digital telecommunications.
3. Implementing acquired knowledge in professional specialist courses (theoretical and practical).
4. Understanding basic operation settings for telecommunication systems and equipment.

Unit No	**Syllabus**	**No. of Teaching Hours**
1	**Introductory Concepts:** What Is Telecommunication?, Introductory Topics in Telecommunications, End-Users, Nodes, and Connectivity, Telephone Numbering and Routing, The Use of Tandem Switches in a Local Area, Introduction to the Busy Hour and Grade of Service, Simplex, Half-Duplex, and Full Duplex, One-Way and Two-Way Circuits, Network Topologies, Variations in Traffic Flow, Quality of Service, Standardization in Telecommunications.	**8**
2	**Signals Convey Intelligence :** Basic Concepts of Electricity for Communications, Early Sources of Electrical Current, The Electrical Telegraph: An Early Form of Long-Distance Communications Electrical Signals, Introduction to Transmission, Modulation, Binary Digital Signals, Introduction to Transporting Electrical Signals, Wire Pair, Coaxial Cable Transmission, Fiber-Optic Cable, Radio Transmission	**7**
3	**Quality of Service and Telecommunication Impairments** Quality of Service: Voice, Data, and Image, Signal-to-Noise Ratio, Voice Transmission, Data Circuits, Video (Television), The Three Basic Impairments and How They Affect the End-User, Amplitude Distortion, Phase Distortion, Noise, Typical Levels, Echo and Singing.	**8**
4	**Transmission and Switching: Cornerstones of a Network:** Traffic Intensity Defines the Size of Switches and the Capacity of Transmission Links, Traffic Studies, Discussion of the Erlang and Poisson Traffic,	**8**

Course Outcomes:

1. Explain basic physical and technical principles of modern digital telecommunications,
2. Describe basic principles of operation in modern digital telecommunication equipment and systems,
3. Demonstrate measurements and experiments in laboratory on actual components, devices, equipment and systems in telecommunications,
4. Describe development and implementation methods of telecommunication systems,
5. Examine communication equipment for the technical functionality

Note:

3. In Unit 5, Composite signal in Television transmission is identified for blended learning.
4. Students submit three assignments covering five units with higher level questions upto level.

Course Outcomes: After the completion of the course, the student will be able

1. Explain the basic concepts of telecommunication, transmission and switching.
2. Apply the knowledge of modulation in various communication modalities.
3. Analyze the procedures involved in telephone communication.
4. Analyse the traffic flow and impact on telecommunication infrastructure.
5. Demonstrate the working of electrical signal for carrying intelligence.

	Formulas, Waiting Systems (Queueing), Dimensioning and Efficiency, Quantifying Data Traffic, Introduction to Switching, Basic Switching, Concentration and Expansion, Local Switch, Early Automatic Switching Systems, Common Control (Hard-Wired), Stored Program Control, Concentrators and Remote Switching,	
5	**Voice Telephony & Television Transmission :** Definition of the Voice Channel, The Human Voice, Operation of the Telephone Subset, The Subset Mouthpiece or Transmitter, The Subset Earpiece or Receiver, Video Transmission, Composite Signal, Critical Video Parameters, Transmission Standard—Level, Video Transmission Standards (Criteria for Broadcasters), Color Transmission.	**8**

Cos	**Mapping with Pos**
CO1	PO1,2,3,4,5,6,8,10
CO2	PO1,2,3,4,5,6,8,10
CO3	PO1,2,3,5,6,8
CO4	PO1,2,3,5,6,8
CO5	PO1,2,3,4,5,6,8,10

TEXT BOOKS:

1. "Fundamentals of Telecommunications" by Roger L. Freeman, Second Edition A JOHN WILEY & SONS, INC., PUBLICATION.
2. H. Taub, D.L. Schilling«Principles of Telecommunication Systems", 3rd edition 2006.
3. Tziolas , M. Salehi, "Communications Systems», 1st edition 2003, University of Athens Eds.

Sub Title : SIGNALS AND SYSTEMS		
Sub Code: 18TE43	**No. of Credits:4= 4:0:0(L:T:P)**	**No. of lecture hours/week : 4 hours**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives :

1. To study the basics of signals, systems and their properties.
2. To learn impulse response representation of Linear Time Invariant systems.
3. To understand properties of impulse response representation, difference and differential equation and block diagram representation.
4. To study and compute Z – transform, its inverse and RoC. To learn unilateral Z-Transforms for solving difference equation.
5. To study Fourier series and transform of signals. To compute frequency domain representation of signals.

UNIT No.	Syllabus Content	No. of Teaching Hours
1	**Basics of Signals and Systems:** Definitions of signal and system, Classification of signals, Sampling of Signals, Basic operations on signals, elementary signals: basic continuous-time signals and discrete-time signals, Properties of systems. Problems.	10
2	**Linear Time Invariant system – 1 :** Introduction, Convolution: Impulse response representation for LTI Systems, Convolution sum and Convolution Integral. Problems. Auto correlation and cross correlation.	9
3	**Linear Time Invariant system – 2 :** Properties of impulse response representation for LTI systems, Differential and Difference equation representations.	10

4	**Z-Transforms:** Introduction, Z – transform, Properties of ROC, Properties of Z – transforms, Problems Inversion of Z – transforms, Transform analysis of LTI Systems, Unilateral Z- Transform and its application to solve difference equations, Problems.	11
5.	**Fourier Analysis of Continuous Time Signals and systems** : Introduction, Fourier Series representation of periodic signals, Fourier Transform, Properties of Fourier Transforms, Problems. **Fourier Analysis of Discrete Time signals and systems :** Introduction, Discrete Fourier series, Fourier Transform, Properties of Fourier Transforms, Problems.	12

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

CO1: Understand signals, systems & their representation in time and frequency domains.
CO2: Evaluate the response of the system in time and frequency domains.
CO3: Analyze frequency domain representation of continuous time and discrete time systems.
CO4: Apply transformation to analyze signal characteristics in time and frequency domain.
CO5: Apply properties of transforms to solve problems on LTI systems.

Cos	Mapping with POs
CO1	PO1, PO 2, PO 3, PO 5, PO 8
CO2	PO 2, PO 3, PO 5, PO 8
CO3	PO 2, PO 3, PO 5, PO 8
CO4	PO1, PO 2, PO 3, PO 8
CO5	PO1, PO 2, PO 3, PO 5, PO 8

TEXT BOOKS:

1. Simon Haykin and Barry Van Veen "Signals and Systems", Wiley India Pvt Ltd, 2nd Edition, 2007.

REFERENCE BOOKS / WEBLINKS :

1. M J Roberts, "Signals and Systems", Mc Graw Hill, 2nd Edition, 2011.
2. I J Nagrath, S N Sharan, R Ranjan and S Kumar. "Signals and Systems" TMH, 2002.
3. H P Hsu "Signals and Systems", Scham's outlines, TMH, 2008.
4. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems", Pearson Education Asia / PHI, 2nd Edition, 2015.
5. https://engineering.purdue.edu/ChanGroup/ECE302Notes/Book_v1.pdf

SUB TITLE : FUNDAMENTALS OF HARDWARE DESCRIPTION LANGUAGE		
Sub Code: 18TE44	**No. of Credits: 3= 3:0:0(L:T:P)**	**No. of lecture hours/week : = 3 hours**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives :

1. To understand the Description used in HDL languages.
2. To design simple logic circuits and also implementation of various digital logic design in various applications.
3. To understand the Structural type description used as pointers in C Language.
4. Basic concepts of synthesis are described.
5. To understand the mixed typed and mixed language description.

UNIT No	Syllabus Content	No. of Teaching Hours
1	**Introduction:** Why HDL? A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog, Introduction to XILINX , XILINX version of ModelSim, a Verilog Simulator.	07
2	**Data –Flow Descriptions**: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type- Vectors, **Behavioral Descriptions (VHDL and Verilog)**: Behavioral Description highlights, Structure of HDL behavioral Description, The HDL Variable –Assignment Statement, Sequential statements	09
3	**Structural Descriptions**: Highlights of structural Description, Organization of the structural Descriptions. **Procedures and Tasks :** Highlights of Procedures and tasks Functions (HDL).	07
4	**Synthesis Basics:** Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.	07
5	**Mixed –Type Descriptions**: Why Mixed-Type Description? HDL User-Defined Types, HDL Packages, Mixed-Type Description examples	09

	Mixed –Language Descriptions (VHDL and Verilog): Highlights of Mixed-Language Description, How to invoke One language from the Other, Mixed-language Description Examples, Limitations of Mixed-Language Description.	

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

CO1: Remember and define different types of Description of HDL.
CO2: Understand the basics of digital design and Invoking from Verilog to VHDL
CO3: Analyze the Structural, Behavioral and dataflow description.
CO4: Develop and execute algorithms for Mixed Type and Mixed Langauge descriptions
CO5: Design, apply and test combinational and sequential circuits, in HDL to verify the functionality.

Cos	Mapping with POs
CO1	PO1, PO2, PO3, PO4 , PO7
CO2	PO1, PO2, PO3, PO4, PO6
CO3	PO1, PO2, PO3, PO6, PO7
CO4	PO3, PO6, PO5, PO8, PO10
CO5	PO1,PO2, PO3, PO4

TEXT BOOKS:

1. "HDL Programming (VHDL and Verilog)"- Nazeih M.Botros- Dreamtech Press, Aug-2006.

2. "**A Verilog HDL Primer"**- J.Bhaskar – BS Publications, 2nd Edition, 2001.

REFERENCE BOOKS/WEBLINKS:

1. "Verilog HDL"–Samir Palnitkar -Pearson Education, 2nd Edition, Feb 21, 2003.

2. VHDL -Douglas Perry-Tata McGraw-Hill 3rd Edition, 2002.

3. https://electrobotss.files.wordpress.com/2014/01/ ece-iv-fundamentals-of-hdl-10ec45-notes.pdf

Sub Title : TRANSMISSION LINES AND WAVE GUIDES		
Sub Code: 18TE45	**No. of Credits : 4=4:0:0(L:T:P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives :

1. To introduce the types of Transmission Lines and analyze of their circuit equivalent.
2. To understand the concept of Standing waves.
3. To learn use of Smith chart.
4. To understand different types of propagation in Guided waves.
5. To Study waves in rectangular guide, Attenuation in co-axial line, excitation, and resonant cavities

UNIT No.	Syllabus Content	No. of Teaching Hours
1	**Transmission – Line Theory** :The transmission Line general solution, Physical significance of the equations; the infinite line, The distortion less Line, The telephone cable, Reflection on a Line not terminated in Z_0, Open and short circuited Lines, Reflection loss, Insertion loss, T and PI sections equivalent to Lines, relevant problems . **(Text 1)**	12
2	**Impedance matching :** standing waves; nodes ; standing wave ratio. input impedance of dissipation less line, input impedance of open- and short-circuited lines, single-stub impedance matching, The quarter wave Line and its applications, relevant equations and problems. **(Text 1)**	10
3	**Smith Chart and its applications :** Smith Circle diagram, Applications of Smith chart, Single-stub impedance matching with Smith Chart. **(Text 1)**	08
4	**Guided waves :** Applications of restrictions to Maxwell's equation, types of propagation; TM, TE and TEM, Transmission of TM,TE and TEM waves in parallel planes. (Text 1 & 2)	10

5.	**Wave guides :** Application of Maxwell's equations to the rectangular wave guides, The $TM_{m,n}$ wave in the rectangular guide, The $TE_{m,n}$ wave in the rectangular guide, The TEM wave in the coaxial Line, Attenuation in the coaxial Line, Excitation of wave guides, Guide terminations, Resonant cavities (Text 1 & 2)	**12**

Note :

- Unit 5 **Wave Guides** is identified for blended learning.
- Students submit **three assignments** covering five units.

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

CO1 : Explain various types of transmission lines, types of losses and distortions in them.
CO2 : Computation of parameters related to standing wave and learning design strategies for impedance matching.
CO3 : Use Smith chart to solve problems associated with transmission lines and impedance matching.
CO4 : Analyse types of guided wave between two parallel planes.
CO5: Analyse presence of modes in various types of waveguides.

Cos	Mapping with Pos
CO1	PO1,PO2,PO8
CO2	PO1,PO2,PO3
CO3	PO1,PO2
CO4	PO1,PO2,PO10
CO5	PO1,PO2,PO3

TEXT BOOKS:

1."**Network Lines and Fields**" , John D Ryder, 2 edition, PHI, 2005.

REFERENCE BOOKS/WEBLINKS:

1. "**Transmission Lines and Networks**", Umesh Sinha, 8th edition, Satya Prakashana (Tech India Publication), 2003.
2. "**Networks and systems**", Roy Choudhury,2nd edition,2009, New Academic Science Ltd.

Sub Title : MICROCONTROLLER LAB		
Sub Code: 18TEL46	**No. of Credits : 1 = 0 : 0 : 3 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 =100**	

Course Objectives :

1. Write and execute programs on arrays using assembly language programs for 8051.
2. To learn bit manipulation and code conversion programs using assembly language programs for 8051.
3. To learn programs on timers, serial port programming and interrupts using assembly language programs for 8051.
4. To execute LCD, ADC and Keyboard interfacing programs for 8051 using C language.
5. To execute ADC, RTC and Stepper Motor interfacing programs for 8051 using C language.

I. ASSEMBLY & C LANGUAGE PROGRAMMING

1. Assembly language program (ALP) to exchange a block of data with another block.
2. ALP to add n 1-byte numbers and store 16-bit sum.
3. ALP to add two multi byte numbers
4. ALP to subtract an 8-bit number from another 8-bit number using 2's complement method.
5. ALP to count number of one's in a given byte.
6. ALP to find the largest element of an array of N eight-bit numbers and count number of bytes.
7. ALP to sort the given array of N elements in ascending order.
8. ALP to find square and cube of an 8-bit binary number.
9. ALP to implement 16-bit Counters (Up counter and down counter) using delay subroutine.
10. ALP to check whether the given byte is a valid bit palindrome
11. ALP to transfer a string of data from code space.
12. ALP to transfer a string of data using serial communication.
13. Assembly language program to implement 4:1 multiplexer circuit.
14. Assembly language program to convert BCD to ASCII using logical instructions and arithmetic instructions.
15. C program to toggle all the bits P0 and P2 continuously with some delay.
16. C program to send a string to serial port.

II. INTERFACING USING 8051 MICROCONTROLLER:

1. C program to display BCD up counting.
2. C program for key board interface to display the key pressed on LEDs using 8051 microcontroller.
3. C program for LCD interface to display a string using 8051 microcontroller.
4. C program for generation of waveforms – Square and Triangular using DAC interface using 8051 microcontroller.
5. C program for Stepper motor control to change the direction of rotation and speed using 8051 microcontroller.

Course Outcomes :

CO1: Learnt simple assembly language programs for 8051 Microcontroller.
CO2: Developed and executed assembly language programs using different types of Instructions for 8051 Microcontroller.
CO3: Learnt assembly language programs using different types of instructions for 8051 Microcontroller.
CO4: Written and executed C programs for 8051 Microcontroller.
CO5: Coded and executed C programs for interfacing 8051 Microcontroller.

Cos	**Mapping with POs**
CO1	PO1, PO3,PO4
CO2	PO1,PO3, PO4
CO3	PO3,PO4, PO7
CO4	PO3, PO4, PO5
CO5	PO3,PO5, PO8, PO10

Sub Title : PROGRAMMING IN HDL LAB		
Sub Code: 18TEL47	**No. of Credits :1 = 0 : 0 : 3 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 =100**	

Course objectives :

1. To teach basic programming in HDL for logic gates.
2. To teach programming of different sequential and combinational logic circuits.
3. To teach different types of description of a Full Adder.
4. To teach the interfacing of seven segment.
5. To teach the control the speed and direction of Stepper motor

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi/TK Base 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.

PROGRAMMING (using VHDL and Verilog)

1. Write HDL code to realize all the logic gates.
2. Write a HDL program for the following combinational designs
   a. 2 to 4 decoder.
   b. 8 to 3 (encoder with priority).
   c. 8 to 1 multiplexer.
   d. 4 bit binary to gray converter.
   e. 4 bit comparator.
3. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
4. Write a HDL model for 4 bit ALU which decode the 3 bit op-code according to the given example 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 HDL code for the following flip-flops, SR, D, JK, T.
6. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and "any sequence" counters.

INTERFACING

1. Write VHDL code to display messages on the given seven segment display.
2. Write VHDL code to control speed, direction of Stepper motor.
3. Write VHDL code to generate different waveforms (Square, Triangle, Ramp) using DAC change the frequency and amplitude.
4. Write HDL code to control external lights using relays.

Demonstration Experiments:

1. Write VHDL code to simulate Elevator operation.

Course Outcomes :

CO1: Design and test circuits of increasing complexity and prototype with FPGA.
CO2: Design and verify the functionality of adder in Dataflow, Behavioral, and structural using HDL.
CO3: Design and test sequential circuits using RTL description, interface stepper motor and DAC with FPGA.
CO4: Implement digital circuits with Verilog & VHDL.
CO5: Design and test the circuits of MUX, comparator, Gray to binary.

COs	**Mapping with POs**
CO1	PO1,PO 2, PO4, PO10
CO2	PO1, PO2, PO3, PO4, PO8
CO3	PO1, PO2, PO3, PO 4, PO 7
CO4	PO1, PO2, PO3, PO4, PO9
CO5	PO1, PO2, PO3, PO5, PO6, PO9

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E TELECOMMUNICATION ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	Hu	18HS51	M&E	Hu	3	--	--	03	50	50	100	3
2	PC	18TE51	Digital Signal Processing		2	2	--	03	50	50	100	3
3	PC	18TE52	Analog Communication		3	2	--	03	50	50	100	4
4	PC	18TE53	Antenna & Wave Propagation		3	--	--	03	50	50	100	3
5	PC	18TE54	ARM Processor and Embedded System Design		4	--	--	03	50	50	100	4
6	PE	18TE55X	Professional Elective-1		3	--	--	03	50	50	100	3
7	OE	18TEE01	Open Elective -A		3	--	--	03	50	50	100	3
8	PC	18TEL57	Signals systems and DSP Lab		--	--	2	03	50	50	100	1
9	PC	18TEL58	Analog Communication & LIC Lab		--	--	2	03	50	50	100	1
				TOTAL	21	4	4	27	450	450	900	25

Mini-project: To be carried out during the intervening vacations of V and VI semesters. The SEE examination will be conducted during VI semester. The credit prescribed for mini – project is added to VI semester credits. The mini-project is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the mini-project will be declared as failed and have to complete during subsequent SEE examination after satisfy the Mini-project requirements. Also, mini-project is considered for eligibility to VII semester.

Note: Hu: Humanities, PC: Professional Core, MC: Mandatory Course,

Course code	Professional Electives -1
18TE551	Control Systems
18TE552	OOPs using C++
18TE553	VLSI in Telecommunication Engineering
18TE554	Principles of RADAR Engineering

Course code	Open Elective - A
18TEE01	Embedded System Design
18TEE01	VLSI in Telecommunications

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E TELECOMMUNICATION ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory **Lecture**	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	Hu	18HS61	IPR	Hu	3	--	--	03	50	50	100	3
2	PC	18TE61	Computer Communication Network		4	--	--	03	50	50	100	4
3	PC	18TE62	Information Theory & Coding		3	--	--	03	50	50	100	3
4	PC	18TE63	Digital Communication		3	2	--	03	50	50	100	4
5	PE	18TE64X	Professional Elective -2		3	--	--	03	50	50	100	3
6	OE	18TEE02	Open Elective -B		3	--	--	03	50	50	100	3
7	PC	18TEL66	Digital Communication Lab		--	--	2	03	50	50	100	1
8	PC	18TEL67	Computer Communication Network Lab		--	--	2	03	50	50	100	1
9	MP	18TEMP68	Mini-project					03	50	50	100	2
10	INT	18TEI69	Internship	(To be carried out during the intervening vacations of VI and VII semesters)				--	--	--	--	--
			TOTAL		**19**	**2**	**4**	**27**	**450**	**450**	**900**	**24**

Note: PC: Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-Project, INT: Internship.

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A University examination will be conducted during VIII semester and prescribed credit are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent University examination after satisfy the internship requirements.

Electives

Course code	Professional Electives -2
18TE641	Cryptography & Network Security
18TE642	Advanced Signal Processing
18TE643	Satellite Communication
18TE644	Data structures using C++

Open Elective -A

Students can select any one of the open electives (Please refer to consolidated list of Dr AIT for open electives) offered by any Department. Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Mentor.

Course code	Open Elective -B
18TEE02	Principles of RADAR Engineering
18TEE02	Satellite Communication

Sub Title : Digital Signal Processing		
Sub Code: 18TE51	**No of Credits : 3=2:1:0 (L-T-P)**	**No of lecture hours/week : 2+2=4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No of Contact Hours : 52**

Course Objectives :

1. To introduce signals, systems, time and frequency domain concepts, frequency domain sampling, DFT and its properties and linear filtering.
2. To compute DFT using FFT algorithms.
3. To study and design analog and digital IIR filters and analog to digital filter transformation.
4. To study windows and frequency sampling method for FIR filter design.
5. To learn implementation of IIR and FIR filters by direct form – I and II, cascade, lattice and parallel realization.

UNIT No	Syllabus Content	No. of Hours	
		Teaching	Tutorial
1	**Discrete Fourier Transforms (DFT) & its Properties:** 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, additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Introduction to Matlab.	06	04
2	**Fast-Fourier-Transform (FFT) algorithms:** Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).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.	06	04
3	**IIR filter design:** Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during	07	05

	mapping.		
4	**FIR filter design:** Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlet and Kaiser windows, FIR filter design using frequency sampling technique.	06	04
5.	**Implementation of discrete-time systems**: Structures for IIR and FIR systems- direct form I and direct form II systems, cascade, lattice and parallel realization.	06	04

Note: Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

1. Solves problems on Discrete Fourier Transforms (DFT), its Properties and linear filtering.
2. Computes DFT efficiently using Fast-Fourier-Transform (FFT) algorithms.
3. Designs analog filters and digital IIR filters using transformation techniques.
4. Designs FIR filter using windows and frequency sampling method.
5. Implements block diagram representations of IIR and FIR filters.

COs	**Mapping with POs**
CO1	PO1, PO2, PO3, PO4, PO5, PO8
CO2	PO1, PO2, PO3, PO4, PO5, PO8
CO3	PO1, PO2, PO3, PO4, PO5, PO8
CO4	PO2, PO3, PO4, PO5, PO8
CO5	PO2, PO3, PO4, PO5, PO8

TEXT BOOKS:

1. Digital signal processing – Principles Algorithms and Applications, John G Proakis and Dimitris G Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS/WEBLINKS :

1. https://www.math.utah.edu/~wright/misc/matlab/matlabintro.html
2. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
3. Digital Signal Processing, Li Tan: Elsevier publications, 2007.
4. Digital Signal Processing, S K Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
5. http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials

Sub Title :Analog Communication		
Sub Code: 18TE52	**No of Credits : 4=3:2:0 (L-T-P)**	**No of lecture hours/week : 5**
Exam Duration : 3 hours	**CIE +Assignment + Activity +SEE = 40 + 5 + 5 + 50 =100**	**Total No of Contact Hours : 65**

Course Objectives:

1. Ability to apply Mathematical concepts of convolution and Fourier Transforms to arrive at the time-domain and frequency-domain representation of amplitude modulated and angle and its generation methods, DSBSC modulation.
2. Ability to apply Mathematical concepts of convolution, correlation and Fourier Transforms to arrive at the canonical representation of band-pass signals and SSBSC generation methods, time- domain description of SSB using canonical representation
3. Ability to understand concept of VSB both in time and frequency-Domain.
4. To understand the concept of Angle modulation.
5. To learn the impact of noise in modulated waves.

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Unit No	**Syllabus**	**No. of hours**	
		Teaching	**Tutorial**
1	**Standard AM:** Introduction to AM, Time-Domain and Frequency – Domain descriptions of Standard AM, Generation of AM wave: square law modulator, switching modulator. Detection of AM waves : square law detector, envelop detector. **Double side band suppressed carrier modulation (DSBSC):** Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves, Costas loop.	08	05
2	**Single Sideband Suppressed Carrier (SSBSC) :** Hilbert transform, properties of Hilbert transform, Pre-envelope, Frequency-Domain description of SSB wave, Time- Domain Description of SSB using canonical representation, Phase discrimination method for generating an SSB modulated wave, Time-Domain description, Phase discrimination	09	06

	method for generating an SSB modulated wave, Demodulation of SSB waves.		
3	**Vestigial Sideband Modulation (VSB)and Applications of AM :** Frequency – Domain description, Generation of VSB modulated wave, Time – Domain description, Envelop detection of VSB wave plus carrier, Frequency translation, Frequency division multiplexing, Application : AM radio .	09	06
4	**Angle Modulation :**Basic definitions, Comparison of FM and PM narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM. Demodulation of FM waves, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Applications - stereo multiplexing, FM Radio	07	05
5	**Noise :** Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise Temperature, cascade connection of two-port networks. **Noise in Continuous wave Modulation Systems :** Introduction, Noise Power Spectral Density, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Pre-emphasis and De-emphasis in FM.	06	04

Note:

1 Unit 4 is identified for blended learning.

2 Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes:

CO1: Determine the performance of analog modulation schemes in time and frequency domains.
CO2: Determine the performance of systems for generation and detection of modulated analog signals.
CO3: Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms.
CO4: llustrate the applications of various modulation schemes.
CO5: Characterize the influence of channel on analog modulated signals.

Cos	**Mapping with Pos**
CO1	PO1,PO2, PO5, PO10
CO2	PO1, PO2, PO5, PO10
CO3	PO1, PO2, PO5, PO10
CO4	PO1, PO2, PO10
CO5	PO1, PO2, PO5, PO10

TEXT BOOKS :

1. An Introduction to Analog and Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
2. Communication Systems, Simon Haykin, 5th Edition, John Willey India Pvt. Ltd, 2009.

REFERENCE BOOKS:

1. Modern digital and analog Communication systems B. P. Lathi,3rd Ed 2005 Oxford University press.
2. Communication Systems : A Bruce Carlson, Paul Crilly and Janel C Rutledge, McGraw-Hill Higher Education, 4th edition.
3. Communication Systems: Analog and digital, Singh and Sapre ,TMH 2nd , Ed 2007.

Subject Title : ANTENNA AND WAVE PROPAGATION		
Sub Code :18TE53	**No. of credits : 3=3:0:0(L-T-P)**	**No. of lecture hrs/week : 3**
Exam duration : 3hrs	**CIE +Assignment + Activity +SEE = 40 + 5 + 5 + 50 =100**	**Total No. of Contact Hours :39**

Course Objectives:

1. To understand the radiation mechanisms of antennas and also to learn about basic parameters of antennas.
2. To understand the concepts of point sources and arrays.
3. Have an insight into various Broad band antennas.
4. To study various narrow band antennas.
5. Learn to acquire thorough understanding of the radio wave propagation.

UNIT No.	Syllabus	No. of Teaching Hours
1	**Fundamental Concepts:** Basic Antenna Parameters (concept of radiation), Antenna parameters: Radiation pattern, gain, directivity, effective aperture, Effective Height, Beam Efficiency, Retarded Potential A Far field due to an alternating current element, Antenna field zones. **(Text 1)**	8
2	**Point Sources:** Introduction, Power theorem and its applications, Radiation intensity, Power patterns,	8

	Examples of Power patterns, Field patterns, Phase patterns. **Antenna arrays:** Arrays of two isotropic point sources, Arrays of Non-isotropic sources, Pattern multiplication, Array of n- isotropic point sources with equal amplitude and spacing, Broadside and End fire arrays. **(Text 1)**	
3	**Antennas:** Small Loop, Horn Antenna, Helical Antenna, (Geometry and modes), Frequency independent concepts: Rumsey's principle; log spiral antenna and log periodic antenna.. Reflector Antennas (9.1),Corner Reflector(9.3),The parabola general properties, The paraboloidal reflector, Feed methods for parabolic reflectors. **(Text 1)**	8
4	**Microstrip Antenna:** Introduction, Salient features, advantages, limitations, feed methods, method of analysis, Techniques for size reduction, Applications, Design considerations for the lab experiments. **(Text 1)**	8
5.	**Wave Propagation:** The Fundamental equation for free space propagation, modes of propagation, Structure of atmosphere, Characteristics of different ionized regions, sky wave propagation and Definitions, Skip distance, optimum working frequency, Ionospheric abnormalities(11.16.1-11.16.5), Ionospheric absorption and multi hop propagation, space wave propagation(11.9.1 and 11.19.4),Duct propagation. **(Text 2)**	7

Note:

1. In Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes:

1. Describe the basic concept of antenna, its significance in wireless communication and understand the general terms associated to design antenna with its working conditions.
2. Define, describe the array of antennas, point sources, isotropic and non-isotropic sources and conditions to increase the directivity of array antennas.
3. Apply and Simulate the concepts of point sources and arrays of antennas.
4. Demonstrate and Simulate the importance of all types of antennas is realized with practical implication of antennas
5. Understand the knowledge of the structure of atmosphere, modes of propagation methods.

COs	**Mapping with PO's**
CO1	P01,PO2,PO3, PO6,PO10
CO2	PO2,PO3,PO6,PO8

CO3	PO4, PO5,PO9
CO4	PO2,PO3,PO4,PO9
CO5	PO1,PO2,PO3,PO4.PO5,PO10

TEXT BOOKS:

1. **"Antenna and Wave Propagation**", John D Kraus, Ronald J. Marhefka and Ahmed S Khan, Fourth edition, Mc Graw Hill Publication, 2010.
2. "**Antenna and Wave Propagation**", Prasad K D , 3rd edition, Satya Prakashan, New Delhi 1996.

REFERENCE BOOKS/WEBLINKS:

1. Antenna Theory Analysis and Design - C A Balanis, 3rd Edn, John Wiley India Pvt. Ltd., 2008.
2. Antennas and Propagation for Wireless Communication Systems - Sineon R Saunders, John Wiley India Pvt. Ltd., 2008.
3. Prasad K D, "Antenna and Wave Propagation", 3rd edition, Satya Prakashan, New Delhi (1996).
4. studynama.com/community/threads/207-Antenna-Wave-propagation-(AWP)-pdf-notes-ebook-download

Sub Title :ARM processor and Embedded System Design		
Sub Code: 18TE54	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + Activity +SEE = 40 + 5 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives:

1. To learn system design for measurement of embedded system operating characteristics and to determine system performance relative to functional requirements.
2. Studying complete design of an embedded system with functional requirements for hardware and software components including processor.
3. To learn design and implementation of software systems to provide an interface between hardware peripheral sensors and systems.
4. To learn designing of an embedded system with functional requirements for RTOS architecture.
5. To study design of an embedded system with functional requirements for RTOS architecture ,Principles also memory space and memory power.

Unit No.	Syllabus	No. of Teaching Hours
1	**INTRODUCTION**: Overview of embedded systems, embedded system design challenges, common design metrics and optimizing. Survey of different embedded system design technologies, trade-offs.	10
2	**SINGLE-PURPOSE PROCESSORS**: Hardware, Combinational Logic, Sequential Logic, RT level Combinational and Sequential Components, Optimizing single-purpose processors. Single-Purpose Processors: Software, Basic Architecture, Operation	10
3	**Standard Single-Purpose Peripherals**: Timers, Counters, UART, PWM, LCD Controllers, Keypad controllers, Stepper Motor Controller, A to D Converters, Examples. **MEMORY**: Introduction, Common memory Types, Compulsory memory, Memory Hierarchy and Cache, Advanced RAM. Interfacing, Communication Basics, Microprocessor Interfacing,	10
4	**INTERRUPTS** : Basics - Shared Data Problem - Interrupt latency. Survey Of Software Architecture, Round Robin, Round Robin with Interrupts - Function Queues - scheduling - RTOS architecture. **INTRODUCTION TO RTOS** : Tasks - states - Data - Semaphores and shared data.	10
5	**INTRODUCTION TO ARM PROCESSOR:** Acorn RISC Machine – Architecture Inheritance – ARM Programming Model- ARM Development Tools – 3 and 5 Stage Pipeline ARM Organization - ARM Instruction Execution and Implementation – ARM Co-Processor Interface(Blended learning).	12

Note:

1. Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes: After the completion of the course, the student will be able

1. Explain the design for measurement of embedded system operating characteristics and to determine system performance relative to functional requirements.
2. Apply the concepts related to design of an embedded system with functional requirements for hardware and software components including processor.

3. De sign and implement software systems to provide an interface between hardware peripheral sensors and systems.
4. Analyse the functional requirements for RTOS architecture for the efficient system design.
5. Demonstrate the functional requirements to solve system design problems.

COs	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO5, PO6, PO8,PO10
CO3	PO1, PO5,PO6
CO4	PO1,PO5,PO6,PO8
CO5	PO1, PO5,PO6

TEXT BOOKS:

1. Embedded System Design A unified hardware/software introduction– Frank Vahid,Tony Givargis, John Wiley & Sons, Inc.2002
2. An Embedded software Primer – David E. Simon, Pearson Education, 1999.

REFERENCE BOOKS:

1. "Introduction to Embedded systems", by SHIBU.K.V McGRaw Hill Education (India) Private limited.
2. Embedded Systems: Architecture and Programming – Raj Kamal, TMH.
3. Embedded Systems Architecture – Tammy Noergaard.
4. Comprehensive Guide for Engineer and Programmers –Elsevier Publication 2005
5. "ARM Processor on-chip" by Steve Furber.

Professional Electives -1

Sub Title : Control Systems		
Sub Code: 18TE551	**No of Credits : 3 = 3:0:0(L:T:P)**	**No of lecture hours/week : 3**
Exam Duration : 3	**CIE+SIE=50+50=100**	**Total No of Contact Hours : 39**

Course Objectives :

1. To learn the fundamental concepts of Control systems and mathematical modelling of the system.
2. To study block diagram reduction techniques and signal flow graph method for finding transfer function of whole system.
3. To study the concept of time response of the system.
4. To understand the basics about stability of a system.
5. To get introduced to various stability analysis techniques.

UNIT No	Syllabus Content	No of Hours Teaching
1	**Mathematical Modelling of Systems:** Introduction to Control Systems, Types of Control Systems, Difference between Open loop and closed loop systems, Differential equations of Physical Systems - Mechanical systems both translational and rotational systems, Electrical systems, Analogous networks using both Force-voltage and force-current analogy ,problems	09
2	**Block diagrams and signal flow graphs:** Transfer function, Block diagram reduction techniques, Signal Flow graph, Mason's gain formula, problems	09
3	**Time Response of feedback control systems:** definitions of transient and steady state, Standard test signals , TYPE of system, static error coefficients, steady state errors, Time response specifications of second order systems, problems	06
4	**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis.,problems	07
5.	**Root–Locus Techniques:** Introduction, The root locus concepts, Construction of root loci, problems **Frequency domain analysis:** Bode plots – Magnitude and phase plots, finding the gain margin and phase margin, Predicting the stability of the system	08

Note:

1. In Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level.

Course Outcome :

1. Explain about stability of a system.
2. Applying reduction rules and Mason's gain formula for finding the equivalent transfer function.
3. Analysis of time-response of systems of various TYPE number and order.

4. Evaluation of stability using Routh's array method and Routh Hurwitz's criterion.
5. Construction of mathematical model for electrical and mechanical system, Root locus , Bode-plot.

TEXT BOOK:

1. Control Systems Engineering, J. Nagarath and M.Gopal, New Age International (P) Limited, Sixth edition – 2018.
2. Automatic Control Systems, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.

REFERENCE BOOKS :

1. Modern Control Engineering , K. Ogata, Pearson Education Asia/PHI, 5th Edition, 2010.
2. Control Systems Engineering, Norman S.Nise, Wiley-India (P) Ltd., 7th Edition, 2015.

Sub Title : Object Oriented Programming using C++		
Sub Code:18TE552	**No of Credits :3= 3-0-0(L-T-P)**	**No of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No of Contact Hours : 39**

Course Objectives:

1. To learn the concepts of object oriented programming.
2. To learn the basic concepts and functions in C++.
3. To learn programming in C++ using classes and objects.
4. To study constructors, destructors and operator overloading concepts.
5. To study inheritance and virtual functions in C++.

UNIT No	Syllabus	No. of Teaching hours
1	**Beginning with C++:** Object Oriented Programming Paradigm**,** Basic concepts of OOP**,** Benefits of OOP, Applications of C++,Structure of C++ program, Tokens, Keywords, Identifiers, Data types, User Defined Data types, Derived Data types, Symbolic constants, Dynamic Initialization of variables.	08
2	Reference Variables**,** Operators in C++, Scope Resolution Operators, Memory	08

	Management Operators, Manipulators, Type-cast operators, Operator precedence, Control Structures, Functions prototyping, Call by reference, Return by reference, Inline function, Default arguments, Function Overloading.	
3	**Classes and objects** : Specifying the class, Defining member functions, Nesting of member functions, Private Member functions, Arrays within a class, Memory allocation for objects, Static Data members, Static member functions, Arrays of objects, Objects as function arguments, Friendly functions.	08
4	**Constructors, Destructors and operator overloading:** Parameterized Constructors, Constructors with default arguments, Copy constructor, Const Objects, Destructors Operator Overloading Unary and binary operators, Overloading binary operators using friends.	08
5	Inheritance, Defining Derived classes, Single, Multilevel, Multiple hierarchical and hybrid inheritance, Virtual base classes, Abstract classes, Constructors and derived classes, Pointers, Pointers to objects, Pointers to derived classes. (Blended Learning)	07

Note:

1. Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes :

1. Apply the basic concepts and structure of OOPs for programming in C++.
2. Describe the object-oriented programming approach in connection with C++.
3. Illustrate the usage of objects and classes.
4. Make use of constructors, destructors and operator overloading in C++ programs.
5. Apply inheritance, virtual and pure functions in C++ programming.

COs	Mapping with Pos
CO1	PO1, PO2
CO2	PO1,PO3,PO7
CO3	PO2,PO6, PO7
CO4	PO1, PO5,PO6
CO5	PO6,PO8 PO9, PO10

TEXT BOOK:

1. Object Oriented Programming with C++, E. Balaguruswamy, Galgotia Publications, 2004.

REFERENCE BOOKS/WEBLINKS :

1. Object Oriented Programming using C++, Robert Lafore, Galgotia publications.

2. C++ Primer , Lippman and Lajoie, 3rd edition, Addison Wesley.
3. www.atilim.edu.tr/~mcs215/Lecture%20Notes/book.pdf

Title : VLSI IN TELECOMMUNICATIONS		
Sub Code:18TE553	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours: 39**

Course objective

1. To teach various modeling & Fabrication Techniques.
2. To illustrate various MOS switches, design equation, resistivity of various layers .
3. To study various primitive logic gates.
4. To understand the different types of flipflops.
5. To understand non ideal effects, dynamic CMOS circuits.

Unit No	**Syllabus**	**No of teaching hours**
1	**Introduction to MOSFETs** : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up	08
2	**MOS Inverter** : MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Resistivity of Various Layers.	09
3	**Combinational MOS Logic Circuits**: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates;	08
4	**Sequential MOS Logic Circuits**: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop.	06
5	**Dynamic Logic Circuits:** Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits	08

Note:

1. Unit 4 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes

1. An ability to analyze fabrication and modeling.
2. An impact knowledge of logic gates, circuits and design equation.
3. To analyze primitive logic gates.
4. To create an understanding of various Flip flops.
5. An understanding of non ideal effects, dynamic CMOS Circuits.

Cos	Mapping with Pos
CO1	PO1,PO2, PO4
CO2	PO1,PO2,PO3, PO4,PO8
CO3	PO1,PO2,PO3, PO4,PO7
CO4	PO1,PO2,PO3, PO4,PO9
CO5	PO1,PO2,PO3, PO5,PO6,PO9

TEXT BOOKS

1. D. A. Pucknell and K. Eshraghian, Basic VLSI Design : Systems and Circuits, Third Edition PHI,1994.
2. W. Wolf, Modern VLSI Design : System on Chip, Third Edition, PH/Pearson, 2002
3. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design: A Systems

REFERENCES:

1. Leon-Garcia, Widjaja, "Communication networks", TMH seventh reprint 2002.
2. Aunurag Kumar, D. MAnjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.

Sub Title : Principles of RADAR Engineering		
Sub Code:18TE554	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours: 39**

Course Objectives

1. To become familiar with fundamentals of RADAR.
2. To gain knowledge in depth knowledge about the different types of RADAR and their operations
3. Understanding the signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques.
5. To become familiar with satellite navigation and hybrid navigation.

Unit No	Syllabus	No. of Teaching hours
1	Detection of Signals in Noise –Introduction – Matched –Filter Receiver – Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters - Frequency-Scan Arrays Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.	08
2	DME and TACAN - Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.	08
3	Introduction - Introduction - Four methods of Navigation . Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - TheGoniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic	08

	Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments.	
4	Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System	08
5	SATELLITE NAVIGATION AND HYBRID NAVIGATION SYSTEM Basics of Satellite Navigation, Introduction to Global Positioning System., System Description, Basic principles, position, velocity determination, Signal structureDGPS, Integration of GPS & INS	07

Note :

1. Unit 5 is identified as blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outocomes :

1. To become familiar with fundamentals of RADAR
2. To gain in depth knowledge about the different types of RADAR and their operations.
3. Need for signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques
5. To become familiar with satellite navigation and hybrid navigation.

Cos	**Mapping with Pos**
CO1	PO1, PO2,PO3,PO4,PO5,PO6,PO8
CO2	PO1, PO2,PO3,,PO5,PO8
CO3	PO1, PO2,PO3,PO4,PO5,PO8
CO4	PO2,PO3,PO4,PO5,PO8
CO5	PO2,PO3,PO4,PO5,PO8,PO10

Text Books :

1. M. I. Skolnik ,"Introduction to Radar Systems", Tata McGraw Hill 2006.

2. Myron Kyton and W. R. Fried "Avionics Navigation Systems" John Wiley &Sons 1997.

REFERENCES

1. Nagaraja "Elements of Electronic Navigation" Tata McGraw Hill, 2nd ed, 2000.

2. Albert Helfrick. D, 'Principles of Avionics', Avionics communications Inc., 2004

3. Nathansan, "Radar design principles-Signal processing and environment", 2/e, PHI, 2007.

4. Hofmann-Wellenhof, Hlichlinegger and J.Collins, "GPS Theory and Practice", 5/e Springer International Edition

5. Roger J.Sullivan, "Radar foundations for Imaging and advanced concepts", PHI, 2004.

Open Elective – A

Sub Title : Embedded System Design		
Sub Code: 18TEE01	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + Activity +SEE = 40 + 5 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To learn system design for measurement of embedded system operating characteristics and to determine system performance relative to functional requirements.
2. Studying complete design of an embedded system with functional requirements for hardware and software components including processor.
3. To learn design and implementation of software systems to provide an interface between hardware peripheral sensors and systems.
4. To learn designing of an embedded system with functional requirements for RTOS architecture.
5. To study design of an embedded system with functional requirements for RTOS architecture ,Principles also memory space and memory power.

Unit No.	Syllabus	No. of Teaching Hours
1	**INTRODUCTION**: Overview of embedded systems, embedded system design challenges, common design metrics and optimizing. Survey of different embedded system design technologies, trade-offs.	8
2	**SINGLE-PURPOSE PROCESSORS**: Hardware, Combinational Logic, Sequential Logic, RT level Combinational and Sequential Components, Optimizing single-purpose processors. Single-Purpose Processors: Software, Basic Architecture, Operation	9
3	**Standard Single-Purpose Peripherals**: Timers, Counters, UART, PWM, LCD Controllers, Keypad controllers, Stepper Motor Controller, A to D Converters, Examples. **MEMORY**: Introduction, Common memory Types, Compulsory memory, Memory Hierarchy and Cache, Advanced RAM. Interfacing, Communication Basics, Microprocessor Interfacing,	9
4	**INTERRUPTS** : Basics - Shared Data Problem - Interrupt latency. Survey Of Software Architecture, Round Robin, Round Robin with Interrupts - Function Queues - scheduling - RTOS architecture.	7
5	**INTRODUCTION TO RTOS** : Tasks - states - Data - Semaphores and shared data.	6

Note:

1. Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes: After the completion of the course, the student will be able

1. Explain the design for measurement of embedded system operating characteristics and to determine system performance relative to functional requirements.
2. Apply the concepts related to design of an embedded system with functional requirements for hardware and software components including processor.
3. Design and implement software systems to provide an interface between hardware peripheral sensors and systems.
4. Analyse the functional requirements for RTOS architecture for the efficient system design.
5. Demonstrate the functional requirements to solve system design problems.

COs	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO5, PO6, PO8,PO10
CO3	PO1, PO5,PO6
CO4	PO1,PO5,PO6,PO8
CO5	PO1, PO5,PO6

TEXT BOOKS:

1. Embedded System Design A unified hardware/software introduction– Frank Vahid,Tony Givargis, John Wiley & Sons, Inc.2002
2. An Embedded software Primer – David E. Simon, Pearson Education, 1999.

REFERENCE BOOKS:

1. "Introduction to Embedded systems", by SHIBU.K.V McGRaw Hill Education (India) Private limited.
2. Embedded Systems: Architecture and Programming – Raj Kamal, TMH.
3. Embedded Systems Architecture – Tammy Noergaard.
4. Comprehensive Guide for Engineer and Programmers –Elsevier Publication 2005

Title : VLSI IN TELECOMMUNICATIONS		
Sub Code:18TEE01	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours: 39**

Course objective

1. To teach various modeling & Fabrication Techniques.
2. To illustrate various MOS switches, design equation, resistivity of various layers .
3. To study various primitive logic gates.
4. To understand the different types of flipflops.
5. To understand non ideal effects, dynamic CMOS circuits.

Unit No	Syllabus	No of teaching hours
1	**Introduction to MOSFETs** : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up	08
2	**MOS Inverter** : MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Resistivity of Various Layers.	09
3	**Combinational MOS Logic Circuits**: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates;	08
4	**Sequential MOS Logic Circuits**: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop.	06
5	**Dynamic Logic Circuits:** Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits	08

Note:

1. Unit 4 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes

1. An ability to analyze fabrication and modeling.
2. An impact knowledge of logic gates, circuits and design equation.
3. To analyze primitive logic gates.
4. To create an understanding of various Flip flops.
5. An understanding of non ideal effects, dynamic CMOS Circuits.

Cos	Mapping with Pos
CO1	PO1,PO2, PO4
CO2	PO1,PO2,PO3, PO4,PO8
CO3	PO1,PO2,PO3, PO4,PO7
CO4	PO1,PO2,PO3, PO4,PO9
CO5	PO1,PO2,PO3, PO5,PO6,PO9

TEXT BOOKS

1. D. A. Pucknell and K. Eshraghian, Basic VLSI Design : Systems and Circuits, Third Edition PHI,1994.
2. W. Wolf, Modern VLSI Design : System on Chip, Third Edition, PH/Pearson, 2002
3. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design: A Systems

REFERENCES:

1. Leon-Garcia, Widjaja, "Communication networks", TMH seventh reprint 2002.
2. Aunurag Kumar, D. MAnjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.

Subject Title : Signals and systems and DSP Lab		
 **Sub Code :18 TEL57**	**No of credits : 1 = 0:0:1(L-T-P)**	**No of hrs/week : 2**
Exam duration : 3hrs	**CIE+SEE = 50 + 50 =100**	

Course Objectives :

1. To verify sampling theorem, compute linear convolution, circular convolution and correlation of sequences.
2. To compute DFT, IDFT, and plot spectra.
3. To design IIR and FIR filters using MATLAB.
4. To compute impulse response, linear convolution, circular convolution, DFT using DSP kits.
5. To demonstrate FIR filter, audio applications and noise addition and removal using DSP kit.

A. LIST OF EXPERIMENTS USING MATLAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.
13. Implement closed loop system using Simulink.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR(TMS320C6713)

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence.
4. Impulse response of first order and second order system.
5. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.

C. DEMONSTRATION EXPERIMENTS

1. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
2. Noise: Add noise above 3 kHz and then remove; Interference suppression using 400 Hz tone.

Course Outcome :

1. Computes impulse response of the system, linear convolution, circular convolution and correlation of sequences.
2. Computes DFT and IDFT using MATLAB.
3. Designs IIR and FIR filters using MATLAB.
4. Computes convolution and DFT using DSP kits.
5. Demonstrates FIR filter, audio applications and noise addition and removal.

COs	**Mapping with POs**
CO1	PO1, PO2, PO3, PO4, PO5, PO8
CO2	PO1, PO2, PO3, PO4, PO5, PO8
CO3	PO1, PO2, PO3, PO4, PO5, PO8
CO4	PO2, PO3, PO4, PO5, PO8
CO5	PO2, PO3, PO4, PO5, PO8

Subject Title : Analog Communication & LIC Lab		
Sub Code :18 TEL58	**No. of credits : 1= 0:0:1(L-T-P)**	**No. of hrs/week : 2**
Exam duration : 3hrs	**CIE+SEE = 50 + 50 =100**	

Course Objectives :

1. Practical understanding of concepts related to Linear Integrated Circuits.
2. To get practical knowledge about the design and analysis of different filters.
3. To design, analyze, and test Class-C tuned amplifier.
4. To design, analyze, and test AM, DSBSC and FM.
5. To design, analyze, and test Precision rectifiers and Transistor mixer.

1. Second order active LPF and HPF
2. Second order active BPF and BEF
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency Synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
    a. Astable multivibrator for given frequency and duty cycle
    b. Monostable multivibrator for given pulse width W
7. Class C Single tuned amplifier
8. Amplitude modulation using transistor/FET (Generation and demodulation)
9. Pulse Amplitude Modulation and Detection.
10. PWM and PPM.
11. Frequency modulation using IC 8038
12. Precision rectifiers-both Full wave and Half Wave
13. Ring Modulator.
14. Transistor Mixer.

Course Outcome :

1. Design analyze, and test different filters.
2. Design, analyze, and test Class-C tuned amplifier.
3. Design, analyze, and test AM, DSBSC and FM**.**
4. Design, analyze, and test Precision rectifiers and Transistor mixer.
5. Design ,analyze and test different modulation and detection schemes.

Sub Title : COMPUTER COMMUNICATION NETWORKS		
Sub Code: 18TE61	**No of Credits : 4=4:0:0(L-T-P)**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No of Contact Hours : 52**

Course Objectives:

1. To define and understand the Layer functions of OSI model and TCP/IP Suite.
2. To study framing, flow control and error control.
3. To understand the different Multiple accesses techniques.
4. To study the standards and protocols of Wired and Wireless LANs.
5. To understand the different addressing modes, IPV4, IPV6 and to implement the different Routing algorithms.

UNIT No	**Syllabus Content**	**No. of Teaching Hours**
1	Layered tasks: OSI Model, Layers in OSI model, TCP/IP Suite, Addressing. Circuit switched Network , Data gram Networks, Virtual circuit Networks	10
2	Data Link Control: Framing, Flow and error control, Protocols, Noiseless channels and Noisy channels, HDLC. Multiple Access: Random access – CSMA, CSMA/CD, CSMA/CA, Controlled access – Reservation, Polling and Token Passing, Channelization – FDMA, TDMA, CDMA.	10
3	LANs: Ethernet: IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet. Wireless LANS: IEEE 802.11, Bluetooth, Connecting Devices: Passive Hubs, Repeaters, Active Hubs, Bridges and Routers.	10
4	Network Layer: Internetworking, IPV4, IPV6, Transition from IPV4 to IPV6, Delivery, Forwarding techniques and Process, Unicast Routing Protocols: Distance vector Routing, Link State Routing, Dijktras Algorithm, Unicast Routing Protocols.	12
5	Transport layer protocols: User Datagram protocol: User Datagram, UDP services, UDP Applications, Transmission Control Protocol: TCP Services,	10

	TCP Features, Segment, Connection, windows in TCP, Flow control, Error control, TCP congestion control.	

Note :

1. Unit 5 is identified as blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

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

1. Explain the architecture of OSI model and TCP/IP model and the switching techniques.
2. Implement Framing of the data, controlling the errors using DLL protocols in HDLC formats.
3. Analyze accessing of channels in a random and controlled manner using different techniques.
4. Analyze the Ethernet standards and wireless LANs.
5. Implement routing in network layer using different algorithms and analyze IPV4 and IPV6 address and their transitions.

COs	Mapping with POs
CO1	PO1, PO5, PO6,PO8
CO2	PO1, PO5, PO6,PO8
CO3	PO2, PO3, PO4
CO4	PO3, PO4, PO10
CO5	PO3, PO4, PO10

TEXT BOOK:

1. **Data Communication and Networking,** B Forouzan, 4th Ed, TMH , 2006.

REFERENCE BOOKS/WEBLINKS:

1. **Computer Networks**, Andrew Tanenbaum, Pearson Education 2008
2. **Computer Networks, James F. Kurose, Keith W. Ross**: Pearson education, 2nd Edition, 2003
3. **Introduction to Data communication and Networking, Wayne Tomasi: Pearson education 2007**
4. **www.tutorialspoint.com/...communication_computer_network/data_communication**

Subject Title : Information Theory and Coding		
Sub Code : 18TE62	**No. of credits : 3=3:0:0 (L-T-P)**	**No. of hrs/week : 3**
Exam duration: 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives :

1. To understand the measure of information content of a Message.
2. To study Coding Techniques using different Algorithms with examples.
3. To analyze the different types of Errors and introduce Error control coding.
4. To study Binary cyclic codes and the calculation of syndrome.
5. To study BCH codes and Burst error correcting codes

Unit No.	Syllabus	No. of hours
		Teaching Tutorials
1	**Information Theory:** Introduction, Measure of Information, Information Content of a Message, Average Information Content(Entropy) of Symbols in Long Independent Sequences, Average Information Content of Symbols in Long Dependent Sequences, Markoff Statistical Model for Information Sources, Entropy and Information rate of Markoff Sources.	08
2	**Source Coding :** Encoding the source output, Shannon's Encoding Algorithm, Shannon's fano encoding algorithm, Huffman Coding, Source Coding theorem, prefix coding,	08
3	**Fundamental Limits on Performance :** Discrete Memoryless Channels, Channel matrix, Joint probability matrix, binary symmetric channel, Mutual Information and its properties, Channel capacity, Channel Coding theorem, Channel Capacity Theorem, Channel Capacity of Binary Erasure channel.	08
4	**Introduction to Error Control Coding :** Introduction, Methods of Controlling Errors, Types of errors, Types of codes, Linear Block Codes – Matrix Description ,Error	08

	Detection and Error correction capabilities, Singal error correction and hamming code.	
5	**Binary Cyclic Codes :** Algebraic Structure of Cyclic Codes, Encoding using (n-k) bit shift register, Syndrome calculation. **Convolutional Codes :** Time domain Approach, Transform domain approach, Trellis and State diagram.	07

Note :

1. In Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level.

Course Outcomes : Students will be able to:

1. Compute entropy and information rate of a source
2. Encode the source output using encoding algorithms and coding techniques
3. Determine the channel capacity of different channels and also the mutual information.
4. Implement the error control coding, methods of controlling errors and Error correction and detection.
5. Encode using bit shift register and syndrome calculation.

COs	Mapping with POs
CO1	PO1, PO5
CO2	PO1,PO2,PO5
CO3	PO4,PO5, PO8
CO4	PO1, PO2, PO10
CO5	PO2,PO6, PO10

TEXT BOOKS :

1.Digital and Analog Communication Systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd., 2008.

2. Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd,2008.

REFERENCE BOOKS /WEBLINKS:

1. Concepts of Information Theory & Coding, Dr.P.S.Satyanarayana, Dynaram Publication,2005

2.Digital Communications Fundamentals and Applications, Bernard Sklar, Prentice Hall International,1988

3.Error Control coding : Fundamentals and Applications, Shu Lin and Costello, New Jersey, 1983

4. Information theory and Coding, K. Giridhar. Pooja Publications, 2010.

5. www.mit.edu/6.933/www/Fall2001/Shannon2.pdf

Sub Title : DIGITAL COMMUNICATION		
Sub Code: 18TE63	**No of Credits : 4= 3:2:0(L-T-P)**	**No of lecture hours/week : 5**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No of Contact Hours : 65**

Course Objectives:.

1. Introduce the concept of sampling theorem, practical application of sampling theorem and time division multiplexing.
2. Extend the knowledge of PCM, DPCM, DM and different companding techniques.
3. To understand the concept of ISI and different methods to overcome the same.
4. To learn and apply the concept of Gram-Schmidt orthogonalization procedure for the signals and to understand and concept of detection and estimation.
5. To make the students to understand the concept of different digital modulation techniques including the Spread Spectrum modulation technique

UNIT No.	Syllabus	No. of Hours	
		Teaching	Tutorials
1	**Basic signal processing operations in digital communication:** Sampling Principles, Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery PAM, TDM.	8	5
2	**Waveform Coding Techniques:** PCM, Quantization noise and SNR, robust quantization DPCM, DM, Adaptive Delta modulation, applications & Problems	8	5
3	**Base-Band Shaping for Data Transmission:** Discrete PAM signals, power spectra of discrete PAM signals. ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.	6	4
4	**Digital Modulation Techniques:** Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques. **Spread Spectrum Modulation:** Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum,	7	7

	coherent binary PSK, frequency hop spread spectrum, applications.		
5	**Detection And Estimation:** Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.	7	5

Note:

1. Unit 4 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes: After the completion of the course, the student will be able

1. Explain the operations involved in digital modulation system.
2. Demonstrate the problem solving skills in communication engineering.
3. Apply the knowledge of basic digital communication concepts to design systems.
4. Analyze the digital modulation techniques for efficient transmission.
5. Design a few operations in digital communication system.

COs	Mapping with POs
CO1	PO1, PO2, PO9
CO2	PO1, PO2, PO3, PO9
CO3	PO1, PO2, PO3, PO4
CO4	PO1, PO2, PO5, PO4, PO9
CO5	PO1, PO2, PO3, PO4, PO9

TEXT BOOK:

1. Digital Communications, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS/WEBLINKS:

1. Digital and Analog Communication Systems, Simon Haykin, John Wiley India Pvt. Ltd., 2008.
2. An introduction to Analog and Digital Communication, K. Sam Shanmugam, John Wiley India Pvt. Ltd., 2008.
3. Digital communications - Bernard Sklar: Pearson education 2007.
4. www.nptel.ac.in/downloads/117105077

Professional elective 2

Sub Title : CRYTOGRAPHY & NETWORK SECURITY		
Sub Code:18TE641	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To provide an introduction to the fundamental principles of cryptography and its applications on the network security domain.
2. To study various approaches to Encryption techniques, Design Principles and Modes of operation.
3. To study a given system with respect to security of the system.
4. To analyze the given system with respect to digital signature and intruders.
5. To analyze the given system with respect to malicious software and firewalls.

UNIT No	Syllabus Content	No of Teaching Hours
1	**Introduction:** Services, mechanisms and attacks, The OSI security architecture, A model for network security. **Symmetric Ciphers**: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher (In brief).	08
2	**Principles of Public-Key Cryptosystems**:Public-key cryptosystems, Applications for public-key cryptosystems, requirements for public-key cryptography,The RSA algorithm, Key Management, Diffie – Hellman Key Exchange.	07

3	**Web Security Consideration**: Security socket layer (SSL), SSL architecture, Transport layer security, Secure Electronic Transaction.	07
4	**Digital signatures**: Requirements, direct digital signature, arbitrated digital signature,Digital Signature Standard , DSS approach, digital signature algorithm.**Intruders**:Intruders, Intrusion techniques, Intrusion Detection, distributed intrusion detection, honeypots, Intrusion detection exchange format.	09
5	**Malicious software**: Viruses and Related Threats, malicious programs, nature of viruses, virus structure, types, Virus Countermeasures, antivirus approaches, advanced antivirus techniques, . **Firewalls**:Firewalls Design Principles, firewall characteristics, types of firewalls, firewall configurations, Trusted Systems, data access control ,concept of trusted systems.	08

Note :

1. In Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions.

Course Outcomes:

CO1: Apply the concepts of cryptographic techniques that provides information and network security.

CO2: Demonstrate the importance of SSL layer and Transport layer security.

CO3:Explain the concepts of public-key cryptosystems.

CO4:Illustrate the importance of Digital signature and Intruders.

CO5:Explain the concepts of malicious software and firewalls.

Cos	**Mapping with POs**
CO1	PO2,PO5, PO10
CO2	PO2,PO5, PO10
CO3	PO2,PO5, PO10
CO4	PO2,PO5, PO10
CO5	PO2,PO5, PO10

TEXT BOOK:

1. **Cryptography and Network Security**– William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security** – Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and network security**– Atul Kahate, , TMH, 2003.
3. williamstallings.com/Extras/Security-Notes/

Sub Title : Advanced Signal Processing		
Sub Code: 18TE642	**No. of Credits : 3=3:0:0(L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To introduce the definition and characteristics of both open and closed loop adaptive systems.
2. To learn and be able to apply the concepts of desired response, error performance function and its minimization and both input and error de-correllation of adaptive linear combiners.
3. To learn and be able to apply the concepts of eigenvalues and eigenvectors, geometric interpretation
4. Error minimization as applied to the quadratic performance surface.
5. To learn and be able to derive and apply gradient search methods to practical problems.

UNIT No	Syllabus	No. of Teaching Hours
1	**Adaptive Systems:** Definition and characteristics, Areas of application, General properties, Open-and closed-loop adaptation, Applications of closed loop adaptation, Example of an adaptive system.	08
2	**The Adaptive Linear Combiner**: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface, Alternative expression of the gradient, Decorrelation of error and input components.	08
3	**Properties Of The Quadratic Performance Surface**: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values, a second example.	08
4	**Searching The Performance Surface**: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning	08

	curve, Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves.	
5	**Gradient Estimation And Its Effects On Adaptation:** Gradient component estimation by derivate measurement, the performance penalty, Derivative measurement and performance penalties with multiple weights, variance of the gradient estimate, effects on the weight-over solution, excess meansquare error and time constants, mis adjustment, comparative performance of Newton's and steepest-descent methods, Total mis adjustment and other practical considerations.	07

Note :

1. In Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions

Course Outcome :

After the course, each student is expected to be able to:

- Design and apply optimal minimum mean square estimators and in particular linear estimators.
- To understand and compute their expected performance and verify it.
- Design, implement and apply Wiener filters (FIR, non-causal, causal) and evaluate their performance.
- Use a combination of theory and software implementations to solve adaptive signal problems.
- Identify applications in which it would be possible to use the different adaptive filtering approaches.

COs	**Mapping with POs**
CO1	PO1,PO2, PO5, PO10
CO2	PO1, PO2, PO5
CO3	PO1, PO2, PO5
CO4	PO1, PO2
CO5	PO1, PO2, PO5

TEXT BOOK:

1. Bernard Widrow and Samuel D. Stearns, Adaptive Signal Processing, Pearson Education Asia, 2001.

REFERENCE BOOKS:

1 .Simon Haykin, Adaptive filter Theory , 4e, Pearson Education Asia, 2002
2. Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, Theory and Design of Adaptive Filters, Pearson education/,PHI 2002.

Subject Title : Satellite Communication		
Sub Code : 18TE643	**No. of credits : 3=3:0:0(L-T-P)**	**No. of hrs/week : 3**
Exam duration : 3hrs	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To become familiar with the different satellite services, orbit concepts.
2. To understand look angles and eclipse effect on communication satellites.
3. To understand the concept of link budget calculation.
4. To learn different subsystems and interference between satellites.
5. To become familiar with different earth segments and satellite access schemes.

Unit No.	**Syllabus**	**No. of Teaching hours**
1	**Orbits :** Introduction, Kepler's Laws, Definitions, Orbital Elements, Apogee and Perigee Heights, Orbital perturbations, Sidereal Time, The Orbital Plane, Sun-synchronous Orbit, Radio wave propogation. - relevant problems	09
2	**Geostationary Orbit :** Antenna Look Angles, Polar Mount Antenna, Limits of Visibility, Earth Eclipse of Satellite, Sun Transit Ouage, Launching Orbits.- relevant problems	06
3	**Space Link :** EIRP, Transmission Losses, Link Power budget equation, System noise, CNR , Uplink, Downlink, Combined CNR.-	06

	relevant problems	
4	**Space Segments :** Power supply, Attitude Control, Station Keeping, Thermal Control, TT&C Subsystem, Transponders **Specialized services :** Satellite Mobile Service,VSATs,Radarsat,GPS. **(Text 2)**	09
5	**Earth Segment :** Receive only home TV system, out door unit, indoor unit, MATV, CATV,Tx-Rx earth station **Satellite Access :** Single Access, Preassigned FDMA, Demand Assigned FDMA, Spade System, PreassignedTDMA,Demand-assigned TDMA	09

Note : 1. Unit 1 is identified for blended learning

2.Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

After completion of the course students will be able to:

1. Analyze different satellites and orbits.
2. Calculate look angle for a satellite.
3. Compute different transmission losses.
4. Analyse of different satellite subsystems.
5. Have the knowledge of various multiple access schemes.

Cos	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO4,PO5,PO6
CO4	PO1,PO2,PO6, PO8
CO5	PO2,PO5,PO6,PO9

TEXT BOOK :

1. Satellite Communications – Dennis Roddy, 4th Edition, McGraw Hill International edition, 2006.
2. Fundamentals of Satellite Communication- S.K.Raman, Pearson Education,2011.

REFERENCE BOOKS/WEBLINKS :

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003

2. Satellite Communication Systems Engineering – W.L.Pitchand, H.L. Sudyderhoud, R.A.Nelson, 2nd Ed., Pearson Education , 2007.
3. www.iridium.com

Sub Title : DATA STRUCTURES USING C++		
Sub Code: 18TE644	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To learn the representation of data structures.
2. To learn programming on arrays and stacks.
3. To learn representation of queues and applications.
4. To learn operations on trees and traversal of trees.
5. To learn representation of skip lists and hashing.

UNIT No.	Syllabus	No. of Teaching Hours
1	**Introduction**: Functions and parameters, Dynamic memory allocation, Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing.	07
2	**Arrays And Matrices**: Arrays, Matrices. **Stacks**: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation	08
3	**Queues**: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked representation, Applications.	07

4	**Binary And Other Trees**: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.	09
5	**Skip Lists and Hashing:** Dictionaries, Linear representation, Skip list presentation, Hash table representation (Blended Learning)	08

Note:

1. Unit 5 is identified for blended learning.
2. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outcomes :

1. Construct data structures using formula based and link based representation.
2. Implementing programming on arrays, matrices and stacks.
3. Apply of representation of queues using C++ language.
4. Develop C++ programs using representation of skip lists and hashing.
5. Analyze the operations on trees and traversal of trees.

COs	Mapping with Pos
CO1	PO1
CO2	PO1
CO3	PO2,PO5
CO4	PO2, PO3,PO4
CO5	PO3,PO4,PO6, PO7,PO10

TEXT BOOK:

1) Data structures, Algorithms, and applications in C++. Sartaj Sahni, McGraw Hill.2000

2) Maria Litvin and Gray Litvin: "Programming with C++ and Data Structures" –Vikas Publication, 2003

REFERENCE BOOKS:

1) Object oriented programming in C++ Balaguruswamy. TMH, 1995

2) Programming in C++ Balaguruswamy. TMH, 1995

Open Elective –B

Sub Title : Principles of RADAR Engineering		
Sub Code:18TEE02	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment +Activity+ SEE = 40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours: 39**

Course Objectives

1. To become familiar with fundamentals of RADAR.
2. To gain knowledge in depth knowledge about the different types of RADAR and their operations
3. Understanding the signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques.
5. To become familiar with satellite navigation and hybrid navigation.

Unit No	**Syllabus**	**No. of Teaching hours**
1	Detection of Signals in Noise –Introduction – Matched –Filter Receiver – Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters - Frequency-Scan Arrays Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.	08
2	DME and TACAN - Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment Aids to Approach and Landing - Instrument Landing System - Ground Controlled	08

	Approach System - Microwave Landing System(MLS) Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.	
3	Introduction - Introduction - Four methods of Navigation . Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - TheGoniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments.	08
4	Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System	08
5	SATELLITE NAVIGATION AND HYBRID NAVIGATION SYSTEM Basics of Satellite Navigation, Introduction to Global Positioning System., System Description, Basic principles, position, velocity determination, Signal structureDGPS, Integration of GPS & INS	07

Note :

1. Unit 5 is identified as blended learning.
3. Students submit three assignments covering five units with higher level questions upto level 4.

Course Outocomes :

1. To become familiar with fundamentals of RADAR
2. To gain in depth knowledge about the different types of RADAR and their operations.
3. Need for signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques
5. To become familiar with satellite navigation and hybrid navigation.

Cos	Mapping with Pos
CO1	PO1, PO2,PO3,PO4,PO5,PO6,PO8
CO2	PO1, PO2,PO3,,PO5,PO8
CO3	PO1, PO2,PO3,PO4,PO5,PO8
CO4	PO2,PO3,PO4,PO5,PO8
CO5	PO2,PO3,PO4,PO5,PO8,PO10

Text Books :

1. M. I. Skolnik ,"Introduction to Radar Systems", Tata McGraw Hill 2006.

2. Myron Kyton and W. R. Fried "Avionics Navigation Systems" John Wiley &Sons 1997.

REFERENCES

1. Nagaraja "Elements of Electronic Navigation" Tata McGraw Hill, 2nd ed, 2000.

2. Albert Helfrick. D, 'Principles of Avionics', Avionics communications Inc., 2004

3. Nathansan, "Radar design principles-Signal processing and environment", 2/e, PHI, 2007.

4. Hofmann-Wellenhof, Hlichlinegger and J.Collins, "GPS Theory and Practice", 5/e Springer International Edition

5. Roger J.Sullivan, "Radar foundations for Imaging and advanced concepts", PHI, 2004.

Subject Title : Satellite Communication		
Sub Code : 18TEE02	**No. of credits : 3=3:0:0(L-T-P)**	**No. of hrs/week : 3**
Exam duration : 3hrs	**CIE +Assignment +Activity+ SEE =** **40 + 5 + 5+ 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To become familiar with the different satellite services, orbit concepts.
2. To understand look angles and eclipse effect on communication satellites.
3. To understand the concept of link budget calculation.
4. To learn different subsystems and interference between satellites.
5. To become familiar with different earth segments and satellite access schemes.

Unit No.	**Syllabus**	**No. of Teaching hours**
1	**Orbits :** Introduction, Kepler's Laws, Definitions, Orbital Elements, Apogee and Perigee Heights, Orbital perturbations, Sidereal Time, The Orbital Plane, Sun-synchronous Orbit, Radio wave propogation. - relevant problems	09
2	**Geostationary Orbit :** Antenna Look Angles, Polar Mount Antenna, Limits of Visibility, Earth Eclipse of Satellite, Sun Transit Ouage, Launching Orbits.- relevant problems	06
3	**Space Link :** EIRP, Transmission Losses, Link Power budget equation, System noise, CNR , Uplink, Downlink, Combined CNR.- relevant problems	06
4	**Space Segments :** Power supply, Attitude Control, Station Keeping, Thermal Control, TT&C Subsystem, Transponders **Specialized services :** Satellite Mobile Service,VSATs,Radarsat,GPS. **(Text 2)**	09

5	**Earth Segment :** Receive only home TV system, out door unit, indoor unit, MATV, CATV,Tx-Rx earth station **Satellite Access :** Single Access, Preassigned FDMA, Demand Assigned FDMA, Spade System, PreassignedTDMA,Demand-assigned TDMA	09

Note : **1.** Unit 1 is identified for blended learning

2.Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

After completion of the course students will be able to:

1. Analyze different satellites and orbits.
2. Calculate look angle for a satellite.
3. Compute different transmission losses.
4. Analyse of different satellite subsystems.
5. Have the knowledge of various multiple access schemes.

Cos	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO4,PO5,PO6
CO4	PO1,PO2,PO6, PO8
CO5	PO2,PO5,PO6,PO9

TEXT BOOK :

1. Satellite Communications – Dennis Roddy, 4th Edition, McGraw Hill International edition, 2006.
2. Fundamentals of Satellite Communication- S.K.Raman, Pearson Education,2011.

REFERENCE BOOKS/WEBLINKS :

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003
2. Satellite Communication Systems Engineering – W.L.Pitchand, H.L. Sudyderhoud, R.A.Nelson, 2nd Ed., Pearson Education , 2007.
3. www.iridium.com.

Sub Title : DIGITAL COMMUINICATION LAB		
Sub Code: 18TEL66	**No. of Credits :1=0:0:1 (L-T-P)**	**No. of lecture hours/week : 2**
Exam Duration : 3 hours	**CIE+SEE = 50 + 50 =100**	

Course Objectives :.

1. To familiarize students with the techniques and instrumentation employed for measuring the performance and properties of digital communication systems and to provide hands-on experience with the components and sub-systems employed in a digital communication system.
2. Build ASK,FSK,PSK circuits.
3. Build DPSK, QPSK circuits
4. Build DM and ADM circuits.

LIST OF EXPERIMENTS

1. Verification of sampling Theorem
2. Design a circuit to perform TDM of two band limited signals.
3. Design a circuit to generate and demodulate ASK.
4. Design a circuit to generate and demodulate FSK .
5. Design a circuit to generate and demodulate BPSK .
6. Design a circuit to generate and demodulate PSK .
7. DPSK generation and detection usimg kit.
8. QPSK generation and detection using kit.
9. Delta modulation and demodulation using DM kits.
10. Adaptive delta modulation using DM kit.
11. Sigma modulation using DM kit.

Course Outcome :

After going through this course the student will be able to :

1. Analyze the performance of a baseband communication system that employs ideal Nyquist-based pulse shaping.
2. Analyze the ASK, FSK, PSK circuits
3. Analyze DPSK, QPSK circuits
4. Analyze DM and ADM circuits.

5. Analyze sigma modulation circuit.

COs	Mapping with POs
CO1	PO1,PO2, PO5, PO10
CO2	PO1, PO2, PO5
CO3	PO1, PO2, PO5
CO4	PO1, PO2
CO5	PO1, PO2, PO5

Sub Title : Computer Communication Network LAB		
Sub Code: 18TEL67	**No. of Credits:1= 0:0:1 (L:T:P)**	**No. of lecture hours/week : 2**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 = 100**	

Course Objectives:

1. To Study and implement Data Link Layer protocols.
2. To Study and implement the Routing algorithm.
3. To Study and implement the encryption & decryption algorithms
4. To perform Data Communication using different media.
5. To Study and implement Congestion control using Leaky Bucket Algorithm.

I. CCN Programming Experiments in C/C++

1. Simulate Bit stuffing & De-stuffing using HDLC frame format.
2. Simulate Character Stuffing & De-stuffing using HDLC frame format.
3. Encryption and Decryption of a given message using

   i) Substitution Method ii) Transposition Method

4. Compute Polynomial Code Checksum for CRC-CCITT.
5. Simulate the shortest path algorithm using Dijktra's Method.
6. Find Minimum Spanning Tree of a subnet.

7. Write a Program for Congestion Control using Leaky Bucket Algorithm.

II. Hardware Experiment

1. To Communicate between two PCs using the different Media:

   i) RS232 ii) Optical Fiber iii) Twisted Pair.

III. Simulation Programs using Network Simulator 2

1. Simulate a simple topology to create, in ns-2, a topology with the following parameters:
   Link-1: 100Mbps, 50ms latency
   Link-2: 1Mbps, 1ms latency
2. Simulate a three-node point-to-point network with a duplex link between them. Connect node n0 with n2 and node n1 with n2. Create UDP traffic between node n0 to n2 and n1 to n2. Set the packet size to 512 bytes and set the packet delay as 0.010 seconds. Observe the simulation to find the number of packets dropped.
3. Simulate a 4-node point-to-point network and connect the link as follows: Create a UDP agent and attach to node1. Set the band width of 1Megabits and delay of 10ms between node1 and node2. Set 2Megabits bandwidth and delay of 20ms between node2 and node3. Find the minimum packet size required to set the data without lose.

IV. Demo Experiments using QualNet Simulator

1. Simulate a three point to point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets.
2. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare Throughput.

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

1. Frame the data with Bit and Character stuffing and destuffing and to Analyze Error Correction and Detection using Polynomial code check sum.
2. Implement Routing Algorithm to find the shortest path using Djktra's Algorithm and minimum spanning tree.
3. Perform Simulation of Encryption and Decryption of the given message using different methods.
4. Communicate between two PCs using different media.
5. Simulate and analyze network topology using Network Simulator 2.

Cos	**Mapping with POs**
CO1	PO1, PO5
CO2	PO1,PO2,PO5
CO3	PO2,PO3, PO4,PO10
CO4	PO2,PO5
CO5	PO2, PO3, PO10

Sub. Title : MINI PROJECT		
Sub. Code: 18TEMP68	**No. of Credits : 2**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+SIE=50+50=100**	

1. Project group should comprise of 3 or 4 students and should not exceed 4 students.
2. Project proposal (synopsis) submitted by the student must be related to the field of telecommunication.
3. Project should be based on recent technology.
4. Evaluation will be done on the basis of implementation, demonstration and viva-voce.

List of softwares & Hardwares available:-

Softwares:-

1.Xilinx Embedded Development Software V 14.2.

2. VLSI VHDL DESIGN TOOL FOR FPGA/CPLD Xilinx ISE with modelsim X-E starter & XST synthesizer V 7.1 i

3. TMS 230C2000 CCS DSK.

4.TMS 230C5000 DSP Platform CCS DSK.

5. Matlab Version 8.3 R2014 a.

6. Matlab Version 7.1 R2006a+.

7. Mentor Graphics software.

8. Matlab version 6.5 Signal tool processing.

9. FEKO-EM Simulation & Antenna Design and Synthesis Software V.7.

10. Network simulator 2.

11. QUALNET.

Hardwares:-

1. DSP Starter Kits.

2. VLSI H/W kits Universal FPGA system Xilinx FPGA kits.

3. Data Communication trainer kit.

4.DSP 6437 digital video development platform.

5.iSense sensor network starter training Kit.

Sub. Title : INTERNSHIP		
Sub. Code: 18TEI69	**No. of Credits : - =- :-:- (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+SIE= -**	

1. Internship is conducted for individual student or groups, enhances practical knowledge regarding technical and social aspects.
2. Student document their internship period as a report and submit it to the department.
3. Evaluation will be done on the basis of relevance of the topic, presentation skills, depth of knowledge and documentation.

Dr. Ambedkar Institute of Technology
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SCHEME OF TEACHING AND EXAMINATION VII SEMESTER (Autonomous) 2019-20 ACADEMIC YEAR
B.E., TELECOMMUNICATION ENGINEERING

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial	Practical / Project	CIE	SEE	Total	
1.	**HS04**	Intellectual Property Rights	**HS**	02	-	-	25	25	50	2
2.	**TE71**	Optical Fiber Communication	**TE**	03	-	-	50	50	100	3
3.	**TE72**	Mobile Communication	**TE**	04	-	-	50	50	100	4
4.	**TE73**	Computer Communication Networks	**TE**	02	02	-	50	50	100	3
5.	**TE74x**	*Elective –2 (Group – B)	**TE**	03	-	-	50	50	100	3
6.	**TEL75**	Optical & Microstrip Lab	**TE**	-	-	3	50	50	100	1.5
7.	**TEL76**	CCN lab	**TE**	-	-	3	50	50	100	1.5
8.	**TEP77**	Project Work Phase-I	**TE**	-	-	-	50	-	50	-
9.	**IDE**	Inter-Dept. Elective*	**TE**	04	-	`-	50	50	100	4
Grand Total							425	375	800	22

*** Elective2 : Group B**	
TE741	Modeling & Simulation of Data Networks
TE742	CAD for VLSI
TE743	Data Structures using C++
TE744	Digital Image Processing
TE745	Video Engineering
TE746	Internet of Things

*** Inter-Departmental Electives offered to other Departments**	
TEE01	Internet Engineering and Application
TEE02	Real Time Operating systems
TEE03	DSP Algorithms & Architecture
TEE04	RADAR and Radio Aids to Navigation

Chairman-BOS

Dr. Ambedkar Institute of Technology
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SCHEME OF TEACHING AND EXAMINATION VIII SEMESTER (Autonomous) 2019-20 ACADEMIC YEAR
B.E., TELECOMMUNICATION ENGINEERING

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks			Examination Credits
				Lecture	Tutorial	Practical / Project	CIE	SEE	Total	
1.	**TE81**	Optical Networking	**TE**	03	-	-	50	50	100	3
2.	**TE82**	Multimedia Communication	**TE**	03	-	-	50	50	100	3
3.	**TE83x**	Elective-3 Group C	**TE**	04		-	50	50	100	4
4.	**TEP84**	Project Work Phase II	**TE**	-	-	2	50	50	100	12
5.	**TES85**	Subject Seminar	**TE**	-	-	-	50	-	50	2
6.	**IDE**	**Inter-Dept. elective***	**TE**	4	-	-	50	50	100	4
							300	250	550	28

*** Elective 3: Group C**	
TE831	Adhoc Wireless Networks
TE832	Cryptography & Network Security
TE833	VLSI in Telecommunications
TE834	High performance computer networks
TE835	GSM

*** Inter-Departmental Electives offered to other Departments (Offered in 7th and 8th Semesters)**	
TEE01	Internet Engineering and Application
TEE02	Real Time Operating systems
TEE03	DSP Algorithms & Architecture
TEE04	RADAR and Radio Aids to Navigation

Chairman-BOS

Sub Title : OPTICAL FIBER COMMUNICATION		
Sub Code: TE71	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

- To define and study fundamental principles and operations of optical fiber communication.
- To study optical sources and detectors.
- To study and understand optical analog and digital links and optical networks**.**

UNIT No.	Syllabus	No. of Teaching Hours
1	**OVERVIEW OF OPTICAL FIBER COMMUNICATION:** Introduction- Historical development, The general system, Advantages of optical fiber communication; Ray theory transmission- Total internal reflection, Acceptance angle, Numerical aperture, Skew rays; cylindrical fiber- Step index fibers, Graded index fibers; Single mode fibers- Cutoff wave length, Mode-field diameter and spot size. (Text -1)	08
2	**TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:** Introduction, **A**ttenuation; Material absorption losses in silica glass fibers- Intrinsic absorption, Extrinsic absorption; Linear scattering losses- Rayleigh scattering, Mie scattering; Non-linear scattering losses -Stimulated Brillouin scattering, Stimulated Raman scattering; Fiber bend loss; -Dispersion - Chromatic dispersion –Material dispersion, Waveguide dispersion; Intermodal dispersion –Multimode step index fiber, Multimode graded index fiber, Modal noise; Overall fiber dispersion- Multimode fibers, Single mode fibers. (Text-1)	08
3	**OPTICAL SOURCES AND DETECTORS:** **OPTICAL SOURCES:** Introduction; LED power and efficiency- The double-heterojunction LED; LED structures-Surface emitter LEDs, Edge emitter LEDs, characteristics-Optical output power, Output spectrum, Modulation Bandwidth, Reliability. **OPTICAL DETECTORS:**Introduction; Optical detection principles; Absorption-Absorption coefficient, Quantum efficiency; Responsivity; Semiconductor photodiodes without internal gain- The p-n photodiode, The p-i-n photodiode; Semiconductor photodiodes with internal gain- avalanche photodiodes, Phototransistors; (Text -1)	08
4	**ANALOG AND DIGITAL LINKS:** **ANALOG SYSTEMS:** Introduction, Overview of Analog links, Carrier-to-noise ratio- Carrier Power, Photodetector and Preamplifier Noises, Relative Intensity Noise(RIN), Reflection Effects on RIN, Limiting Conditions;	07

	Multichannel Transmission Techniques- Multichannel Amplitude Modulation, Multichannel Frequency Modulation, Subcarrier Multiplexing **DIGITAL TRANSMISSION SYSTEMS:** Introduction, Point–to–Point links - System Considerations, Link Power Budget, Rise-Time Budget (Text -2)	
5	**OPTICAL AMPLIFIERS AND NETWORKS**: **OPTICAL AMPLIFIERS:** Basic Applications and Types of Optical Amplifiers – General Applications, Amplifier Types; Erbium Doped Fiber Amplifiers- Amplification Mechanism, EDFA Architecture, EDFA Power-Conversion Efficiency and Gain. **OPTICAL NETWORKS:** Introduction, Basic Networks–Network Topologies, Performance of Passive Linear Buses, Performance of Star Architecture ; Ultra-High Capacity Networks –Ultrahigh Capacity WDM Systems, Bit-Interleaved Optical TDM, Time-Slotted Optical TDM (Text -2)	08

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcome :

- To define fundamental principles of optical fiber communication.
- To analyze the characteristics and losses in optical fiber transmission.
- Response of optical sources and detectors and study of losses in optical passive components.
- To analyze optical receivers and design of optical analog and digital links.
- To analyze the working principle of optical amplifiers and basic optical networks.

COs	Mapping with POs
CO1	PO1, PO5, PO6,PO8
CO2	PO1, PO5, PO6,PO8
CO3	PO2, PO3, PO4
CO4	PO3, PO4, PO10
CO5	PO3, PO4, PO10

TEXT BOOKS:

1. **Optical Fiber Communications**– – John M. Senior, Pearson Education. 3rd Edition, 2010.
2. **Optical Fiber Communication** – Gerd Keiser, 4th Ed., MGH, 2008.

REFERENCE BOOK:

1. **Fiber Optic communication** – Joseph C Palais: 4th Edition, Pearson Education
2. http://ecee.colorado.edu/~mcleod/teaching/ugol/lecturenotes/Lecture%2013%20Fiberoptics.pdf

Sub Title : MOBILE COMMUNICATION		
Sub Code: TE72	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives:

After completing the course, the students should:

1. Analyse the environment in which the wireless industry operates.
2. Understand the different propagation mechanisms of wireless signals.
3. Understand different modulation schemes used in wireless communications.
4. Understand the concepts of different multiple access techniques used for wireless communication.
5. Become familiar with 3G technologies.

Unit No.	Syllabus	No. of Teaching hours
1	**Introduction to wireless communication system & Networks:** Histroy & Evolution of mobile radio communication, Different generation of WirelessCellular Networks 1G,2G, 3G and 4G. Examples of Wireless Communication System.**Cellular Concept:** Frequency reuse. Channel Assignment Stratergies, Interference and System Capacity, Trunking and Grade of Service, Improving Capacity in Cellular Systems.	10
2	**Mobile radio propagation(large scale path loss):**Free space propagation model, relating power to electric field, three basic propagation mechanisms, reflection, Two-ray model, diffraction, outdoor and indoor propagation models	10
3	**Mobile radio propagation(Small scale fading and multipath):**Small scale multipath propagation, impulse response model, small scale multipath measurement, parameters of mobile multipath channels, types of small scale fading. **Digital modulation:** Overview , line coding, pulse shaping techniques, linear modulation techniques.	11
4	**Speech coding:** Characteristic, quantization, ADPCM, frequency domain coding of speech, vocoders, linear predictive coders. **Multiple access techniques for wireless communication:** FDMA , TDMA, Spread spectrum multiple access, space division multiple access	11
5	**3G Digital cellular technology**:2.5G TDMA,GPRS ,EDGE Technologies,Need for 3G cellular network,IMT-2000 global standard,UMTS technology,W-CDMA air interface,TD-SCDMA technology,CDMA 2000 cellular technology.	10

	Military Mobile Communications: Strategies used in jammingEnvironment,Spread Spectrum Scheme Coding Scheme, Adaptive antenna nulling.	

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. Demonstrate cellular radio concepts in the design of wireless communication systems
2. Analyse different propagation mechanisms.
3. Study small scale propagation models and modulation scheme of wireless communication systems .
4. Understand different multiple access schemes and speech coding
5. Learn about 3G wireless technology

Cos	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO4,PO5,PO6
CO4	PO1,PO2,PO6,PO8
CO5	PO2,PO5,PO6,PO9

TEXT BOOKS:

1. **Wireless communications –Theodore.S.Rappaport**.PHI,second edition.
2. **Mobile Communication Engineering** – **William C Y Lee**, Second edition, TataMcgraw Hill

REFERENCE BOOKS/WEBLINKS:

1. **Mobile Cellular Telecommunication** – Lee W.C.Y, MGH, 2002.
2. **Wireless communication** – D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication** – David Tse, PramodViswanath, Cambridge

Sub Title : COMPUTER COMMUNICATION NETWORKS		
Sub Code: TE73	**No of Credits : 3=2:2:0(L-T-P)**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No of Contact Hours : 52**

Course Objectives:

1. To define and understand the Layer functions of OSI model and TCP/IP Suite.
2. To study framing, flow control and error control.
3. To understand the different Multiple accesses techniques.
4. To study the standards and protocols of Wired and Wireless LANs.
5. To understand the different addressing modes, IPV4, IPV6 and to implement the different Routing algorithms.

UNIT No	**Syllabus Content**	**No. of Hours**	
		Teaching	**Tutorial**
1	Layered tasks: OSI Model, Layers in OSI model, TCP/IP Suite, Addressing. Circuit switched Network , Data gram Networks, Virtual circuit Networks	06	06
2	Data Link Control: Framing, Flow and error control, Protocols, Noiseless channels and Noisy channels, HDLC.	04	04
3	Multiple Access: Random access –CSMA, CSMA/CD, CSMA/CA, Controlled access – Reservation, Polling and Token Passing, Channelization – FDMA, TDMA, CDMA.	04	04
4	LANs: Ethernet: IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet. Wireless LANS: IEEE 802.11, Bluetooth, Connecting Devices: Passive Hubs, Repeaters, Active Hubs, Bridges and Routers.	06	06
5	Network Layer: Internetworking, IPV4, IPV6, Transition from IPV4 to IPV6, Delivery, Forwarding techniques and Process, Unicast Routing Protocols: Distance vector Routing, Link State Routing, Dijktras Algorithm	06	06

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes : Students will be able to:

1. Understand the architecture of OSI model and TCP/IP model and the switching techniques.
2. To implement Framing of the data, controlling the errors using DLL protocols in HDLC formats.
3. Access the channels in a random and controlled manner using different techniques.
4. Analyze the Ethernet standards and wireless LANs.
5. Implement routing in network layer using different algorithms and analyze IPV4 and IPV6 address and their transitions.

COs	Mapping with POs
CO1	PO1, PO5, PO6,PO8
CO2	PO1, PO5, PO6,PO8
CO3	PO2, PO3, PO4
CO4	PO3, PO4, PO10
CO5	PO3, PO4, PO10

TEXT BOOK:

1. **Data Communication and Networking,** B Forouzan, 4th Ed, TMH , 2006.

REFERENCE BOOKS/WEBLINKS:

1. **Computer Networks**, Andrew Tanenbaum, Pearson Education 2008
2. **Computer Networks, James F. Kurose, Keith W. Ross**: Pearson education, 2nd Edition, 2003
3. **Introduction to Data communication and Networking, Wayne Tomasi: Pearson education 2007**
4. **www.tutorialspoint.com/...communication_computer_network/data_communication**

Sub Title : MODELING AND SIMULATION OF DATA NETWORK		
Sub Code: TE741	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No of Contact Hours : 39**

Course Objectives:

1. Study of different delay models in data networks
2. Study of multi access communication in Aloha System and algorithms
3. Study, design and analysis of different routing algorithms
4. To study Optimal routing and its design characterization
5. Study of Flow control in data networks

UNIT No	Syllabus Content	No. of Teaching Hours
1	**DELAY MODELS IN DATA NETWORKS:** Queuing Models, M/M/1, M/M/m, M/M/□, M/M/m/m, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.	08
2	**MULTI-ACCESS COMMUNICATION:** Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Packet Radio Networks	08
3	**ROUTING IN DATA NETWORKS:** Introduction, Network Algorithms and Shortest Path Routing, Broadcasting Routing Information: Coping with Link Failures.	07
4	**ROUTING IN DATA NETWORKS:** Flow models ,Optimal Routing, and Topological design Characterization of Optimal Routing,	08
5	**FLOW CONTROL:** Introduction, Window Flow Control, Overview of Flow Control in Practice(ARPANET,,SNA 440, X.25)	08

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. Realize different delay models in data networks.
2. Anayze Multi access techniques and communication for varied networks.
3. Implement different routing algorithms for data networks.
4. Design optimal routing method for data networks.
5. Understand flow control for data networks.

Cos	Mapping with POs
CO1	PO1
CO2	PO2,PO5
CO3	PO2,PO4
CO4	PO2, PO3,PO10
CO5	PO2,PO3,PO5,PO10

TEXT BOOKS:

1. **Data Networks** – DimitriBertsekas and Robert Gallager,2nd edition, Prentice Hall of India, 2003.
2. **High-Speed Networks and Internets** – William Stallings,Pearson Education (Asia) Pte. Ltd, 2004.

REFERENCES BOOK:

1. **High Performance Communication Networks**– J. Walrandand P. Varaya,2nd edition, Harcourt India Pte. Ltd. & Morgan

Subject Title : **CAD for VLSI**		
Sub Code : TE742	**No. of credits : 3=3:0:0(L-T-P)**	**No. of hrs/week : 3**
Exam duration : 3hrs	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course objectives:

1. To teach knowledge about basic CAD tools, layouts of VLSI.
2. To study the design hardware models and algorithms in VLSI design tools.
3. To study various optimize methods.
4. To verify logic synthesis and verification.
5. To teach how to simulate and verify the written codes.

Unit No	**Syllabus**	**No. of Teaching hours**
1	**INTRODUCTION TO VLSI LAYOUT:** Cad tools, Philiosophy of VLSI, N-MOS and P-MOS transistor structures, scalability, design requirements, Hierarchical representation, testability enhancement	9
2	**HARDWARE MODELING:** Hardware modeling languages, abstract model, compilation and behavioral optimization **A Quick Tour of VLSI Design Automation Tools** - Data structures and Basic Algorithms - Algorithmic Graph theory and computational complexity	9
3	**General purpose methods for combinational optimization** - partitioning - floor planning and pin assignment - placement - routing.	8
4	**Simulation**-logic synthesis -Verification-High level synthesis- Compaction	6
5	**Physical Design Automation of FPGAs,MCMS**-VHDL-Verilog-Implementation of Simple cirucuits using VHDL and Verilog.	7

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. An ability to gain the knowledge about basic CAD tools, layouts of VLSI.
2. An ability to design hardware models and algorithms in VLSI design tools.
3. An ability to gain the knowledge of various optimizing tools.
4. An ability to learn how to simulate and verify the written codes.
5. An ability to design, implementation of simple circuits for FPGA kits.

COs	Mapping with POs
CO1	1,3,9,10
CO2	2,3,9
CO3	3,9,10
CO4	3,9,10
CO5	3,9,10

TEXT BOOKS:

1**. N.A. Sherwani**, " **Algorithms for VLSI Physical Design Automation** ", 1999.
2. **S.H.Gerez**, " **Algorithms for VLSI Design Automation** ", 1998.

REFERENCES :

1. Introduction to VLSI Design – Eugune D Fabricius, MGH, 1990
2. Synthesis and Optimization of digital circuits – Giovanni De Micheli

Sub Title : DATA STRUCTURES USING C++		
Sub Code: TE743	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. To learn the representation of data structures.
2. To learn programming on arrays and stacks.
3. To learn representation of queues and applications.
4. To learn operations on trees and traversal of trees.
5. To learn representation of skip lists and hashing.

UNIT No.	**Syllabus**	**No. of Teaching Hours**
1	**Introduction**: Functions and parameters, Dynamic memory allocation, Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing.	07
2	**Arrays And Matrices**: Arrays, Matrices. **Stacks**: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation	08
3	**Queues**: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked representation, Applications.	07
4	**Binary And Other Trees**: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.	09
5	**Skip Lists and Hashing:** Dictionaries, Linear representation, Skip list presentation, Hash table representation	08

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

1. Understanding the representation of data structures.
2. Implementing programming on arrays and stacks.
3. Applications of representation of queues
4. Knowledge of representation of skip lists and hacking.
5. Analyzing the operations on trees and traversal of trees.

COs	Mapping with Pos
CO1	PO1
CO2	PO1
CO3	PO2,PO5
CO4	PO2, PO3,PO4
CO5	PO3,PO4,PO6, PO7,PO10

TEXT BOOK:

1) Data structures, Algorithms, and applications in C++. Sartaj Sahni, McGraw Hill.2000

2) Maria Litvin and Gray Litvin: "Programming with C++ and Data Structures" –Vikas Publication, 2003

REFERENCE BOOKS:

1) Object oriented programming in C++ Balaguruswamy. TMH, 1995

2) Programming in C++ Balaguruswamy. TMH, 1995

Sub Title : Digital Image Processing		
Sub Code: TE744	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**No. of working hours: 39**

Course Objectives :

1. Understand the basic principles and methods of digital image processing.
2. Be able to formulate solutions to general image processing problems.
3. To learn various image enhancement techniques.
4. To study segmentation techniques used in different applications.
5. To introduce concept of color image processing.

UNIT No	Syllabus Content	No. of Teaching Hours
1	**DIGITAL IMAGE FUNDAMENTALS** Background, 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	9
2	**IMAGE ENHANCEMENT IN SPATIAL DOMAIN** Background, Some Basic Gray Level Transformations, Histogram Processing, Enhancement using Arithmetic/ Logic Operations	8
3	**IMAGE ENHANCEMENT IN FREQUENCY DOMAIN** Introduction to Fourier Transform and the Frequency domain fo image, Smoothing Frequency Domain Filters, Sharpening Frequ domain filters, homomorphic filtering	7
4	**IMAGE SEGMENTATION:** Detection of discontinuities, edge linking and boundary detection, Thresholding, region oriented segmentation, segmentation of morphological watersheds, the use of motion in segmentation	8
5.	**COLOR IMAGE PROCESSING** : Color Fundamentals, Color Models, Pseudo color Image Processing, processing basics of full color image processing	7

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

1. Student will have a clear understanding of representation of a digital image.
2. Student will be able to appreciate the effect of applying various enhancement techniques in spatial domain.
3. Student will be able to observe the impact of frequency domain techniques on images.
4. Relating computer-vision applications with various segmentation techniques.
5. Knowing the applications of various color-models.

COs	Mapping with Pos
CO1	PO1, PO3, PO9,PO10
CO2	PO2, PO3, PO9
CO3	PO3, PO9,PO10
CO4	PO3, PO9,PO10
CO5	PO3, PO9,PO10

TEXT BOOKS

1.Rafel C Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 3rd Edition 2005.
2. S.Jayaraman, S.Esakkirajan, T.Veerakumar," Digital Image Processing,TMH Publication, 2011 edition

REFERENCE BOOKS / WEBLINKS:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", PHI Learning , 3rd Edition
2. Madhuri A Joshi "Digital Image Processing –an alogorithm approach", PHI Learning, 2006
3. http://eeweb.poly.edu/~onur/lectures/lecture8.pdf

Sub Title : VIDEO ENGINEERING		
Sub Code:TE745	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

1. After learning TVE course, students will get benefit to learn and understand the working of real life video system.
2. To be benefited by gaining knowledge of the different elements of video system plus the encoding/decoding techniques.
3. The learners will be groomed up to understand different channel allocations, difference between various systems present in this world, their transmission and reception techniques.
4. Students will get insight on functioning of individual blocks and different standards of compression.
5. They will be acquainted with different types of analog and digital systems also study digital video interfaces.

UNIT No	**Syllabus**	**No. of Teaching Hours**
1	**TV FUNDAMENTALS:** Block schematic of TV systems, picture characteristics, luminous signal, bandwidth calculation, chromatic signal, composite video signal. **NTSC, PAL AND SECAM OVERVIEW:** NTSC overview, luminous information, color information, color modulation, composite video generation, color sub-carrier frequency, NTSC standards, RF modulation , stereo audio. PAL overview, luminance information, color information, color modulation, composite video generation, RF modulation, stero audio (analog). SECAM overview, luminance information, color information, color modulation, composite video generation.	7hrs
2	**NTSC AND PAL DIGITAL ENCODING – DECODING:** NTSC & PAL encoding, luminance, Y processing, color difference processing, C modulation, analog C generation, analog composite video, clear encoding, NTSC & PAL decoding. **VIDEO CODING STANDARDS:** (H.261 & H.263) - H.261, video coding layers, DCT, IDCT, video bit stream, block layer, still image transmission, H.263, video coding layer, GOB layer, MB layer, optional H.263 modes.	7hrs

3	**MPEG 1, 2, 4 AND H.261:** Introduction, MPEG vs JPEG, Quality issues, audio overview, video coding layer, I P B, D frames, video bit stream, video decoding, real world issues.MPEG 2: Introduction, audio overview, video overview, video coding layer, enhances TV programming,	8hrs
4	IPMP.MPEG 4 over MPEG 2, H.264 over MPEG 2, SMPTEVC-9 over MPEG 2, Data broad casting, decoder consideration. MPEG 4 & H.264: Introduction, audio overview, visual overview, Graphic overview, visual layer, object description frame work, scene description, synchronization of elementary streams, multiplexing, IPMP, MPEG 4 part 10 (H.264) video.	9hrs
5	**DIGITAL VIDEO INTERFACES:** pre video component interfaces, consumer component interfaces, consumer transport interfaces.Digital video processing: Rounding considerations, SDTV – ADTV Yeber transforms, 4:4:4 to 4:2:2 Yeber conversion, display enhancement, video mixing and graphic overlay.IPTV: consideration, multicasting, RTS based solutions, ISMA, Broadcast over IP, DRM.	8hrs

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. Understand the fundamentals of Tv systems, NTSC standards and various modulations
2. Understanding the concept of **NTSC AND PAL DIGITAL encoding and decoding.**
3. Understand the concept of **MPEG 1, 2, 4 AND H.261 standards.**
4. Comparison of different standards and audio, vedio and graphic overview.
5. Study of **digital video interfaces.**

COs	**Mapping with POs**
CO1	PO1, PO2,PO3, PO4,PO5,PO6,PO8
CO2	PO2,PO3, PO4,PO5,PO8,PO10
CO3	PO2, PO3
CO4	PO2, PO3
CO5	PO6,PO10

TEXT BOOK:

1. **Video Demystified** – Keith Jack, 4th Edn, Elsevier, 2007.

REFERENCE BOOK:

4. **Modern TV Practice** – R.R.Gulati, 2nd Edn, New age Intl. publications

Sub Title : INTERNET OF THINGS		
Sub Code:TE746	**No. of Credits : 3 = 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Objectives:

1. To study the basics framework and architecture of Internet of Things (IoT).
2. To gain knowledge of IoT design principles.
3. To understand the Internet connectivity principles in IoT.
4. To study sensor & RFID technology for IoT.
5. To gain knowledge on prototyping embedded devices for IoT and M2M.

Unit No.	Syllabus	No. of Teaching Hours
1	**Internet of things: An overview-** Internet o things, IoT Conceptual Framework, IoT Architectural view, Technology behind IoT, Sources of IoT, M2M Communication.	8
2	**Design Principles Of Connected Devices:** Introduction, IoT/M2Msystems layers and design standardization, Communication Technologies, Data enrichment, data consolidation and device management at gateway.	7
3	**Internet Connectivity Principles:** Introduction, Internet connectivity, Internet based communication, IP addressing in the IoT, Media Access control, Application Layer protocols	9
4	**Sensors, Participatory sensing, RFIDs, and Wireless Sensor Networks:** Introduction, Sensor Technology, Participatory sensing, Industrial IoT, Automotive IoT, Actuator, Sensor data communication protocols, Radio Frequency Identification Technology, Wireless Sensor Network Technology	9
5	**Prototyping the Embedded Devices for IoT and M2M:** Introduction, Embedded Computing basics, Embedded platforms for prototyping, Things always connected to the internet/cloud.	6

NOTE : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Outcomes:

1. Knowledge of framework and architecture of IoT.
2. Knowledge of IoT Design principles.
3. Understand the Internet connectivity principles in IoT.
4. Knowledge of sensor and RFID technology for IoT.
5. Knowledge of prototyping embedded devices for IoT and M2M

TEXT BOOKS:

1. "**Internet of Things – Architecture and Design Principles",** Raj Kamal, 2017 McGraw Hill publications.

REFERENCE MATERIALS:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",** 1st Edition, Academic Press, 2014.(**ISBN-13:** 978-0124076846)
2. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014.(**ISBN-13:** 978-8173719547)

COs	**Mapping with POs**
CO1	PO1, PO2,PO3, PO4,PO5,PO6,PO8
CO2	PO2,PO3, PO4,PO5,PO8,PO10
CO3	PO2, PO3
CO4	PO2, PO3
CO5	PO6,PO10

Sub Title : OPTICAL & MICROSTRIP LAB		
Sub Code: TEL75	**No of Credits : 1.5 = 0:0:1.5 (L:T:P)**	**No of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 = 100**	

Course Objectives :. **The objective of this course is**

1. Study of optical fiber transmission characteristics.
2. Study of optical fiber losses (bending loss, propagation loss etc).
3. To study the characteristics and operation of a VCO
4. To realize the practical application of a microwave mixer.
5. To plot the radiation pattern of various microstrip antennas.

List of Experiments:

A**) optical experiments:**

1. Measurement of losses in a given Optical fiber (Propagation loss, Bending loss)
2. Experiment to calculate the numerical aperture of an optical fiber.
3. Analog and Digital (with TDM) communication link using optical fiber

B**) Measurements on Microstrip components (Passive & Active):**

1. Experiment on microstrip power divider.
2. Experiment on Microstrip directional coupler
3. Experiment on Microwave Oscillator (VCO).
4. Experiment on Microwave mixer.
5. Experiment to find the gain of a microstrip antenna
6. Experiment to find the gain and radiation characteristics of a parabolic antenna
7. Experiment to find the gain and radiation characteristics of a horn antenna
8. Experiment to find the dielectric constant of a dielectric material

Course Outcomes :

After going through this course the student will be able to :

1. To determine and analyze optical fiber transmission characteristics.
2. To determine and analyze optical fiber losses.
3. To practically realize the operation of VCO.
4. To practically demonstrate the operation of a microwave mixer.
5. To determine BW and D of various microstrip antennas.

Cos	**Mapping with POs**
CO1	PO1, PO5
CO2	PO1,PO2,PO5
CO3	PO2,PO3, PO4,PO10
CO4	PO2,PO5
CO5	PO2, PO3, PO10

Sub Title : CCN LAB		
Sub Code: TEL76	**No. of Credits:1.5= 0:0:1.5 (L:T:P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 = 100**	

Course Objectives:

1. To Study and implement Data Link Layer protocols.
2. To Study and implement the Routing algorithm.
3. To Study and implement the encryption & decryption algorithms
4. To perform Data Communication using different media.
5. To Study and implement Congestion control using Leaky Bucket Algorithm.

I. CCN Programming Experiments in C/C++

1. Simulate Bit stuffing & De-stuffing using HDLC frame format.
2. Simulate Character Stuffing & De-stuffing using HDLC frame format.
3. Encryption and Decryption of a given message using

   i) Substitution Method ii) Transposition Method

4. Compute Polynomial Code Checksum for CRC-CCITT.
5. Simulate the shortest path algorithm using Dijktra's Method.
6. Find Minimum Spanning Tree of a subnet.
7. Write a Program for Congestion Control using Leaky Bucket Algorithm.

II. Hardware Experiment

1. To Communicate between two PCs using the different Media:

   i) RS232 ii) Optical Fiber iii) Twisted Pair.

III. Simulation Programs using Network Simulator 2

1. Simulate a simple topology to create, in ns-2, a topology with the following parameters:
   Link-1: 100Mbps, 50ms latency
   Link-2: 1Mbps, 1ms latency

2. Simulate a three-node point-to-point network with a duplex link between them.Connect node n0 with n2 and node n1 with n2. Create UDP traffic between node n0 to n2 and n1 to n2. Set the packet size to 512 bytes and set the packet delay as 0.010 seconds. Observe the simulation to find the number of packets dropped.

3. Simulate a 4-node point-to-point network and connect the link as follows: Create a UDP agent and attach to node1. Set the band width of 1Megabits and delay of 10ms between node1 and node2. Set 2Megabits bandwidth and delay of 20ms between node2 and node3. Find the minimum packet size required to set the data without lose.

IV. Demo Experiments using QualNet Simulator

1. Simulate a three point to point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets.
2. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare Throughput.

Course Outcomes :

1. Ability to frame the data with Bit and Character stuffing and destuffing.
2. Ability to find the shortest path between source and destination.
3. Simulation of Encryption and Decryption of the given message.
4. Analyzing Error Correction and Detection using Polynomial code check sum.
5. Ability to communicate between two PCs using different media

Cos	**Mapping with POs**
CO1	PO1, PO5
CO2	PO1,PO2,PO5
CO3	PO2,PO3, PO4,PO10
CO4	PO2,PO5
CO5	PO2, PO3, PO10

Sub. Title : PROJECT WORK PHASE-I		
Sub. Code: TEP77	**No. of Credits : 0=0:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+SIE=50+50=100**	

1. Project group should comprise of 3 or 4 students and should not exceed 4 students.
2. Project proposal(synopsis) submitted by the student must be related to the field of telecommunication.
3. Project should be based on recent technology.
4. Evaluation will be done on the basis literature survey, learning the prerequisite tool, documentation and presentation

Sub Title: Optical Networking		
Sub Code: TE81	**No .of Credits: 3=3:0:0 (L-T-P)**	**No. of lecture hours/week= 3 Hours**
Exam Duration: 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours: 39**

Course Objectives :

(1) To study the environment of optical networks
(2) To study the components both active and passive required for optical networks
(3) To study the design considerations for optical networks
(4) To study the requirement of WDM networks
(5) To understand the functions required for maintenance and control of optical networks

UNIT No	Syllabus	No of Teaching Hours
1	**INTRODUCTION TO OPTICAL NETWORKS**: Telecommunication Network Architecture; Optical Networks--Multiplexing techniques, Second-Generation Optical Networks; All-Optical Networks; Optical Packet Switching; Network Evolution –Early Days-Multimode Fiber, Single-Mode Fiber, Optical Amplifiers and WDM,Nonlinear Effects – SPM, CPM , FWM .	09
2	**COMPONENTS**: Couplers – Principle of Operation, Conservation of Energy; Isolators and Circulators – Principle of Operation; Multiplexes and Filters ; Transmitters – Lasers, Principle of Operation, Longitudinal Modes, Distributed Feedback Lasers, External Cavity Lasers, Vertical Cavity Surface-Emitting Lasers; Switches–Characteristics ; Wavelength converters—Optoelectronic Approach, Optical Gating, Interferometric Techniques, Wave Mixing.	06
3	**TRANSMISSION SYSTEM ENGINEERING**: System model, Power Penalty , Transmitter, Receiver; Optical Amplifiers—Gain saturation in EDFAs, Gain Equalization in EDFAs, Crosssstalk—Intrachannel Crosstalk, Interchannel Crosstalk; Overall Design Considerations.	09
4	**SECOND GENERATION NETWORKS -WDM NETWORK ELEMENTS**: Optical Line Terminals, Optical Add/drop Multiplexers, OADM Architectures, **ACCESS NETWORKS:** Network Architecture Overview, Enhanced HFC.	07
5.	**CONTROL AND MANAGEMENT :** Network Management Functions – Management Framework, Information Model; Optical Layer Services and	08

	Interfacing; Multivendor Interoperability; Performance and Fault Management—BER Measurement, Optical Trace, Alarm Management, Optical safety—Open Fiber Control Protocol.	

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcome :

(1) To analyze the need for overall optical networks
(2) To analyze the working principle of various components of optical networks
(3) To analyze the impact of design considerations of optical networks.
(4) To analyze the components of WDM networks
(5) To analyze the maintenance and control functions required for optical networks

COs	Mapping with POs
CO1	PO1, PO5, PO6,PO8
CO2	PO1, PO5, PO6,PO8
CO3	PO2, PO3, PO4
CO4	PO3, PO4, PO10
CO5	PO3, PO4, PO10

TEXT BOOKS:

1. Optical Networks: A Practical Perspective. Rajiv Ramaswami, Kumar N. Sivarajan, Galen H. Sasaki, 3rd Ed., Morgan Kauffman, 1998 & 2010.

REFERENCE BOOKS:

1. Optical Networks – Ulysees Black, 2nd Ed., Pearson education 2007.

Sub Title :MULTIMEDIA COMMUNICATION		
Sub Code: TE82	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives :

1. To study the different types of Media and their representation in different forms.
2. To understand the different compression techniques for Tex with examples.
3. To understand the different compression techniques for Image with examples.
4. To study the different compression techniques for Audio.
5. To study the different compression techniques for video.

UNIT No	Syllabus	No of Teaching hours
1	**MULTIMEDIA COMMUNICATIONS:** Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS, Application QoS.	07
2	**TEXT AND IMAGE COMPRESSION**: Introduction, compression principles, text compression – Arithmetic coding, Lempel-ziv and Welsh coding, Image compression- GIFF, TIFF, Digitized documents and Pictures, JPEG.	07
3	**AUDIO COMPRESSION:** Introduction, audio compression, LPC, Code excited LPC, Perceptual coding, MPEG Audio coders, Dolby Audio coders. **VIDEO COMPRESSION** : Video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.	07
4	**THE INTERNET**: IP addresses, ARP, RARP, Routing Algorithms-Flooding, Distance vector Routing, Link State & Hierarchical Routing, ICMP, Broadcast Routing, Multicast Routing.	09
5	**BROADBAND ATM NETWORKS:** Cell format and Switching principles, Switching architectures, Protocol architectures. **TRANSPORT PROTOCOLS**: TCP, UDP, RTP and RTCP.	09

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes : Students will be able to:

1. Understand types of Multimedia networks and applications.
2. Illustrate representation of the information of text, images, audio and video.
3. Implement the text and image, Audio and Video compression using different techniques and Standards.
4. Analyze the various Routing algorithms.
5. Understand different Architectures and Protocols.

COs	Mapping with POs
CO1	PO1,PO5
CO2	PO1,PO2,PO5
CO3	PO2, PO6,PO8
CO4	PO2,PO10
CO5	PO1,PO2,PO10

TEXT BOOK:

1. **Multimedia Communications: Applications, Networks, Protocols, and Standards** – Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.

REFERENCE BOOKS:

1. **Multimedia Information Networking** –, Nalin K. Sharda, PHI, 2003.
2. **Multimedia Fundamentals: Vol 1-Media Coding and Content Processing** – RalfSteinmetz, KlaraNarstedt, Pearson Education, 2004.
3. **Multimedia Systems Design** – Prabhat K. Andleigh, KiranThakrar, PHI, 2004

Sub Title : ADHOC WIRELESS NETWORKS		
Sub Code: TE831	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives :

1. To understand Ad hoc Networks and their Issues.
2. To analyze the issues in designing MAC and Routing Protocols.
3. To know the challenges in providing QoS in Ad hoc Networks.
4. To study the Transport Layer Protocols.
5. To study the QoS in Adhoc Networks.

UNIT No	Syllabus Content	No of Hours
1	**AD HOC NETWORKS:** Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless Internet.	08
2	**MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS:** Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms. Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas.	12
3	**ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS:** Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol. Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols	12
4	**TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS:** Introduction, Issues in designing , Design goals , Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks. Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Secure routing in Ad hoc wireless Networks.	12
5	**QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS:** Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions	08

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcome :

1. Analyse users in adhoc networks.
2. To design MAC protocols and to meet design goals.
3. Analyze routing protocols and design different routing protocols.
4. Analyze and design transport layer protocols.
5. Solve the issues of QOS in adhoc networks.

Cos	Mapping with POs
CO1	PO1,PO5
CO2	PO2,PO5
CO3	PO2, PO5,PO10
CO4	PO1,PO2,PO10
CO5	PO2,PO10

TEXT BOOK:

1. **Ad hoc wireless Networks** – C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS/WEBLINKS:

1. **Ad hoc wireless Networks** – Ozan K. Tonguz and Gianguigi Ferrari, Wiley.
2. **Ad hoc wireless Networking**– Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers
3. http://www.alljntuworld.in/wp-content/uploads/2016/01/Adhoc-and-Sensor-Networks-Notes.pdf

Sub Title : CRYTOGRAPHY & NETWORK SECURITY		
Sub Code:TE832	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives:

1. To provide an introduction to the fundamental principles of cryptography and its applications on the network security domain.
2. To study various approaches to Encryption techniques, Design Principles and Modes of operation.
3. To study a given system with respect to security of the system.
4. To analyze the given system with respect to digital signature and intruders.
5. To analyze the given system with respect to malicious software and firewalls.

UNIT No	Syllabus Content	No of Teaching Hours
1	**Introduction:** Services, mechanisms and attacks, The OSI security architecture, A model for network security. **Symmetric Ciphers**: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher (In brief).	12
2	**Principles of Public-Key Cryptosystems**:Public-key cryptosystems, Applications for public-key cryptosystems, requirements for public-key cryptography,The RSA algorithm, Key Management, Diffie – Hellman Key Exchange.	8
3	**Web Security Consideration**: Security socket layer (SSL), SSL architecture, Transport layer security, Secure Electronic Transaction.	8
4	**Digital signatures**: Requirements, direct digital signature, arbitrated digital signature,Digital Signature Standard , DSS approach, digital signature algorithm.**Intruders**:Intruders, Intrusion techniques, Intrusion Detection, distributed intrusion detection, honeypots, Intrusion detection exchange	12

	format.	
5	**Malicious software**: Viruses and Related Threats, malicious programs, nature of viruses, virus structure, types, Virus Countermeasures, antivirus approaches, advanced antivirus techniques, . **Firewalls**:Firewalls Design Principles, firewall characteristics, types of firewalls, firewall configurations, Trusted Systems, data access control ,concept of trusted systems.	12

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. To become familiar with the cryptographic techniques that provides information and network security.
2. To impart knowledge on Encryption techniques, Design Principles and Modes of operation.
3. To analyze a given system with respect to security of the system.
4. To analyze the concept of digital signatures and intruders.
5. To create an understanding of malicious software and firewalls.

Cos	**Mapping with POs**
CO1	PO2,PO5, PO10
CO2	PO2,PO5, PO10
CO3	PO2,PO5, PO10
CO4	PO2,PO5, PO10
CO5	PO2,PO5, PO10

TEXT BOOK:

1. **Cryptography and Network Security**– William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security** – Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and network security**– Atul Kahate, , TMH, 2003.
3. williamstallings.com/Extras/Security-Notes/

Title : VLSI IN TELECOMMUNICATIONS		
Sub Code:TE833	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours: 52**

Course objective

1. To teach various modeling & Fabrication Techniques.
2. To illustrate various MOS switches, design equation, resistivity of various layers .
3. To study various primitive logic gates.
4. To understand the different types of flipflops.
5. To understand non ideal effects, dynamic CMOS circuits.

Unit No	**Syllabus**	**No of teaching hours**
1	**Introduction to MOSFETs** : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up	08
2	**MOS Inverter** : MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Resistivity of Various Layers.	09
3	**Combinational MOS Logic Circuits**: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates;	08
4	**Sequential MOS Logic Circuits**: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop.	06
5	**Dynamic Logic Circuits:** Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits	08

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes

1. An ability to analyze fabrication and modeling.
2. An impact knowledge of logic gates, circuits and design equation.
3. To analyze primitive logic gates.
4. To create an understanding of various Flip flops.
5. An understanding of non ideal effects, dynamic CMOS Circuits.

Cos	Mapping with POs
CO1	PO1,PO2, PO4
CO2	PO1,PO2,PO3, PO4,PO8
CO3	PO1,PO2,PO3, PO4,PO7
CO4	PO1,PO2,PO3, PO4,PO9
CO5	PO1,PO2,PO3, PO5,PO6,PO9

TEXT BOOKS

1. D. A. Pucknell and K. Eshraghian, Basic VLSI Design : Systems and Circuits, Third Edition PHI,1994.
2. W. Wolf, Modern VLSI Design : System on Chip, Third Edition, PH/Pearson, 2002
3. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design: A Systems

REFERENCES:

1. Leon-Garcia, Widjaja, "Communication networks", TMH seventh reprint 2002.
2. Aunurag Kumar, D. MAnjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.

Sub Title : HIGH PERFORMANCE COMPUTER NETWORKS		
Sub Code:TE834	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives

1. To help all sectors of industry exploit the opportunities offered by advanced computing and networking systems to add higher levels of intelligence, reach larger throughputs or ensure shorter response times in their products, processes or services
2. Proposing new designs for high performance network-based computing systems by
3. Developing better middleware, API, and programming environments so that modern network-based computing applications can be developed and implemented in a scalable and high performance manner
4. To learn traffic modeling.
5. To gain complete knowledge of network security and management.

Unit No	Syllabus	No of teaching hours
1	**INTRODUCTION** Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing SONET – DWDM – DSL – ISDN – BISDN,ATM.	10
2	**MULTIMEDIA NETWORKING APPLICATIONS** Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, RSVP- differentiated services.	10
3	**ADVANCED NETWORKS CONCEPTS** VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, and MPLS based VPN, overlay networks-P2P connections	12
4	**TRAFFIC MODELLING** Little's theorem, Need for modeling, Poisson modeling and its failure, Non- poisson models, Network performance evaluation.	10
5	**NETWORK SECURITY AND MANAGEMENT** Principles of cryptography – Authentication – integrity – key distribution	10

	and certification – Access control and: fire walls – attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1	

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Outcomes

1. The student will have complete understanding of OSI, switching, routing.
2. The student can stream audio, video and real time policy mechanisms.
3. Has a complete knowledge of VPN, traffic measurement and overlay networks.
4. Can do traffic modeling.
5. Has a complete knowledge of network security and management.

Cos	Mapping with POs
CO1	PO2
CO2	PO4,PO5,PO10
CO3	PO2
CO4	PO2, PO4
CO5	PO2, PO4, PO5,PO10

TEXT BOOKS:

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003.
2. Walrand. J. Varatya, "High performance communication network", MarganKanffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.

REFERENCES:

1. Leon-Garcia, Widjaja, "Communication networks", TMH seventh reprint 2002.

2. Aunurag Kumar, D. MAnjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.

3. **.** http://www.tti.unipa.it/~ilenia/course/intro.pdf

Sub Title : GSM		
Sub Code:TE835	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives:

1. To become familiar with concepts and standards in wireless communication.
2. To become familiar with the architecture, structure and services offered in GSM.
3. To understand functions and operational principles of the various components of GSM networks, logical channels and frame structures.
4. To learn different coding techniques and call flows.
5. To study different data services and privacy/security.

Unit No.	Syllabus	No. of Teaching Hours
1	**STANDARDS FOR WIRELESS COMMUNICATION SYSTEMS** :Introduction, Cordless systems, GSM, UPT, IMT-2000, UMTS, North American Standards, Japanese Standards **CELLULAR COMMUNICATIONS FUNDAMENTALS :** Introduction, Cellular Systems, Geometry of a Hexagon Cell, Cochannel Interference Ratio, Cellular System Design in Worst case with an omnidirectional antenna, Cochannel interference reduction, directional antennas in 7-cell reuse pattern, Cell splitting	10
2	. **GSM ARCHITECTURE AND INTERFACES**: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), Abits interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers. **RADIO LINK FEATURES IN GSM SYSTEMS**: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna	10
3	**GSM LOGICAL CHANNELS AND FRAME STRUCTURE:** Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.	10

4	(a). **SPEECH CODING IN GSM** : Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder (b)**MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services. GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover.	12
5	(a)**DATA SERVICES IN GSM:** Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS. (b)**PRIVACY AND SECURTIY IN GSM**: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge	10

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

1. Knowledge of concepts and standards used in wireless communication.
2. Understanding of the architecture, structure and services offered in GSM.
3. Understanding functions and operational principles of the various components of GSM networks, logical channels, channel burst and frame structures.
4. Analysis of different coding techniques and call flows.
5. Different services offered by GSM like Group 3 fax, Packet data on the signaling and privacy/security.

Cos	Mapping with POs
CO1	PO1,PO2,PO5,PO6
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO2,PO5,PO6
CO4	PO1,PO2,PO3
CO5	PO2,PO5,PO6,PO9

TEXT BOOKS:

1.Principles of Applications of GSM – Vijay K. Garg& Joseph E. Wilkes, Pearson education, 1999.

REFERENCE BOOKS/WEBLINKS:

1. Z. Zvonar Peter Jung. GSM: Evolution towards 3rd Generation Systems, (Editor), Karl Kammerlander Springer; 1st edition 1998.
2. The Creation of Global Mobile Communication – Friedhelm Hillebrand, GSM & UMTS, John Wiley & Sons; 2001
3. http://www.tti.unipa.it/~ilenia/course/intro.pdf

Sub. Title : Project Work Phase-II		
Sub. Code: TEP84	**No. of Credits : 12=0:0:12 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+SIE=50+50=100**	

1. Project group should comprise of 3 or 4 students and should not exceed 4 students.
2. Project proposal(synopsis) submitted by the student must be related to the field of telecommunication.
3. Project should be based on recent technology.
4. Evaluation will be done on the basis of implementation,results, documentation and presentation

Sub. Title : SUBJECT SEMINAR		
Sub. Code: TES85	**No. of Credits : 0=0:0:2 (L-T-P)**	**No. of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+SIE=50+50=100**	

1. Subject seminar is conducted for individual student.
2. Student should submit a recent topic to the coordinator which needs to be approved by a panel comprising of HOD and coordinator.
3. Evaluation will be done on the basis of relevance of the topic, presentation skills, depth of knowledge and documentation

Sub Title : INTERNET ENGINEERING AND APPLICATIONS		
Sub Code: TEE01	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives

1. To become familiar with Internet Engineering fundamentals.
2. To learn concepts of SDL notations and other specification languages used in Internet.
3. To gain the knowledge of various protocol conformance testing schemes.
4. To learn various methods of Protocol Testing.
5. To understand various synthesis and Re synthesis methods

UNIT No.	**Syllabus**	**No. of Teaching Hours**
1	**Introduction:** Communication model, Communication software, and communication protocol: Representation, Development methods, Protocol engineering process. NETWORK REFERENCE MODEL**:** Layered architecture, Network services and interfaces, protocol functions, OSI model, TCP/IP protocol suite, Application protocols. **Protocol specification**: Communication service specification, Protocol entity specification, Interface specifications, Interactions, Multimedia protocol specifications, Internet protocol specifications.	**12**
2	**Specification and description language (SDL):** A protocol specification language. Examples of SDL based protocol specifications, Other protocol specification languages. Protocol Verification And Validation. **Protocol verification**: Verification of a protocol using finite state machines. SDL based protocol verification, SDL based protocol validation.	**12**
3	**Protocol Conformance Testing**: Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distribute architecture by local methods. Conformance testing with TTCN, Conformance testing of RIP, Multimedia applications testing, SDL based tools for conformance testing.	**12**
4	**Protocol performance testing**: SDL based performance testing of TCP, OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using bridge, Scalability testing.	**8**
5	**Protocol synthesis**: Synthesis methods, interactive synthesis algorithms, automatic synthesis algorithm, automatic synthesis of SDL from MSC protocol re synthesis.	**8**

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes:

1. The students will understand the basic requirements for internet engineering systems.
2. Students will understand the specification in designing protocol engineering systems.
3. Learners will understand Protocol Conformance Testing.
4. To become familiar with SDL based performance testing of various protocols.
5. To acquire knowledge of Protocol Synthesis and Protocol Re-synthesis.

Cos	Mapping with POs
CO1	PO1, PO2, PO3,PO5
CO2	PO2
CO3	PO2, PO4
CO4	PO2,PO5
CO5	PO2, PO9

TEXT BOOK:

1. **Communication protocol engineering**– P. Venkatarm and S. S. Manvi, PHI, 2004

REFERENCE BOOK:

1. **The Internet and its protocols** – Adrian Farrel, Elsevier, 2006.

2.TCP/IP Protocol Stack – B A Forouzan, TMH, 2006

Sub Title : REAL TIME OPERATING SYSTEM		
Sub Code:TEE02	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours : 52**

Course Objectives:

1. Ability to define and classify RTS.
2. To learn scheduling, prioritizing and ITC concepts.
3. To design RTS and different development methodologies.
4. To analyze the RTS, and learn synchronization.
5. To find fault in RTS designed and know the tolerance limits.

UNIT No.	Syllabus	No. of Teaching Hours
1	**Definition and Classification of Real time systems**: Concept of computer control, sequence, loop and supervisor control, centralized, hierarchical and distributed systems, Human Computer interface, hardware requirement for real time applications, specialized processors, interfaces, communications. **Special features of languages for real time application**, review of data types, concurrency, exception handling, co-routines, low-level facilities.	**12**
2	**Real Time Operating Systems:** Scheduling strategies, priority structures, Task management, Real Time Clock Handler, Code sharing, Resource Control, Inter task Communication and Control, Example of Creating and RTOS based on modula 2 kernel;	**10**
3	**Introduction to Design of Real Time Systems**, Specification, Preliminary Design, Multitasking Approach, monitors, Rendezvous. **Development Methodologies**: Yourdon Methodology, Hatley & Pirbhai method.	**10**
4	**Design analysis**: Introduction, Petrinets, Analysis of Petri Nets, Concurrency Control, Disk Scheduling Algorithms, Maintaining Serialization Consistency.	**10**
5	**Fault detection and tolerance:** Introduction, fault tolerance in mixed hardware-software system, fault detection measures, fault detection mechanisms, damage containment and assessment, provision of fault tolerance.	**10**

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

After going through this course the student will be able to :

1. The student should be able to define and classify RTS.
2. Should have learnt scheduling, prioritizing and ITC concepts.
3. Design of RTS, development methodologies.
4. Analyze the RTS, and learn lack synchronization.
5. Able to find fault in RTS designed and know the tolerance limits.

Cos	Mapping with POs
CO1	PO1, PO2
CO2	PO1, PO2, PO5
CO3	PO1
CO4	PO1, PO2,PO8
CO5	PO1, PO2,PO10

Text Book:

1. Stuart Bennett, Real-time Computer Control, second edition, Pearson, 2010.

References:

1. Raj Kamal, Embedded systems, Tata McGraw Hill, India, 2005.
2. Jane. W. S. Liu, Real time systems, Pearson education, 2005.
3.Prof.B.Kantha Rao, Embedded System

Sub Title : DSP ARCHITECTURE AND APPLICATIONS		
Sub Code: TEE03	**No of Credits : 4=4:0:0 (L-T-P)**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No of Contact Hours : 52**

Course Objectives:

1. To learn the architecture features, computational blocks, bus architecture, addressing capability of DSP processors.
2. To learn the external interfacing features of DSP processors,
3. To learn the architecture and instruction set of TMS32OC54xx.
4. To learn EDA tool, assembler directives and CCS for TMS32OC54xx.
5. Ability to write a ALP for a DSP algorithms and implement the same.

Unit No.	**Syllabus**	**No. of Teaching hours**
1.	**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. **ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNALPROCESSORS:** Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.	**10**
2.	**PROGRAMMABLE DIGITAL SIGNAL PROCESSORS:** Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On- Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor. Introduction to TMS320C6713 Floating point DSP Processor.	**12**
3.	**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 TMS32OC54xx.	**12**

4.	**INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO 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).	**09**
5.	**INTERFACING AND APPLICATIONS OF DSP PROCESSOR:** Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.	**09**

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outcomes :

After going through this course the student will be able to :

1. • Design DSP computational blocks
2. Write simple DSP algorithms.
3. Ability to analyze architecture and instruction set of fixed and floating point DSP processor.
4. Ability to interface memory and peripheral devices for system development.
5. Ability to develop application specific solution.

Cos	**Mapping with POs**
CO1	PO1, PO2,PO3,PO4,PO5,PO8
CO2	PO1, PO2,PO3,PO4,PO5,PO8
CO3	PO1, PO2,PO3,PO4,PO5,PO8
CO4	PO2,PO3,PO4,PO5,PO8
CO5	PO2,PO3,PO4,PO5,PO8

TEXT BOOK:

1. **“Digital Signal Processing**”, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

2. “**TMS320C6713 Floating point Digital Signal Processor**” data sheet, Texas Instruments.

REFERENCE BOOKS:

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 Weily, 2008

Sub Title : RADAR &RADIO AIDS TO NAVIGATION		
Sub Code:TEE04	**No. of Credits : 4=4:0:0 (L-T-P)**	**No. of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours: 52**

Course Objectives

1. To become familiar with fundamentals of RADAR.
2. To gain knowledge in depth knowledge about the different types of RADAR and their operations
3. Understanding the signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques.
5. To become familiar with satellite navigation and hybrid navigation.

Unit No	**Syllabus**	**No. of Teaching hours**
1	Detection of Signals in Noise –Introduction – Matched –Filter Receiver – Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters - Frequency-Scan Arrays Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.	10
2	DME and TACAN - Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.	12

3	Introduction - Introduction - Four methods of Navigation . Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - TheGoniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments.	10
4	Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System	10
5	SATELLITE NAVIGATION AND HYBRID NAVIGATION SYSTEM Basics of Satellite Navigation, Introduction to Global Positioning System., System Description, Basic principles, position, velocity determination, Signal structureDGPS, Integration of GPS & INS	10

Note : Three assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3 and 4 , Assignment – 3 from unit 5.

Course Outocomes :

1. To become familiar with fundamentals of RADAR
2. To gain in depth knowledge about the different types of RADAR and their operations.
3. Need for signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques
5. To become familiar with satellite navigation and hybrid navigation.

Cos	Mapping with POs
CO1	PO1, PO2,PO3,PO4,PO5,PO6,PO8
CO2	PO1, PO2,PO3,,PO5,PO8
CO3	PO1, PO2,PO3,PO4,PO5,PO8
CO4	PO2,PO3,PO4,PO5,PO8
CO5	PO2,PO3,PO4,PO5,PO8,PO10

Text Books :

1. M. I. Skolnik ,"Introduction to Radar Systems", Tata McGraw Hill 2006.

2. Myron Kyton and W. R. Fried "Avionics Navigation Systems" John Wiley &Sons 1997.

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1. Nagaraja "Elements of Electronic Navigation" Tata McGraw Hill, 2nd ed, 2000.

2. Albert Helfrick. D, 'Principles of Avionics', Avionics communications Inc., 2004

3. Nathansan, "Radar design principles-Signal processing and environment", 2/e, PHI, 2007.

4. Hofmann-Wellenhof, Hlichlinegger and J.Collins, "GPS Theory and Practice", 5/e Springer International Edition

5. Roger J.Sullivan, "Radar foundations for Imaging and advanced concepts", PHI, 2004.