SHANMUGHA ARTS, SCIENCE, TECHNOLOGY & RESEARCH ACADEMY
(SASTRA UNIVERSITY)

TIRUMALAISAMUDRAM – 613 401

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Study and Syllabi for III to VII Semesters of B.Tech. Electronics & Communication Engineering Programme (Common with) M.Tech. Communication Systems (5 Yrs. Integrated) Programme

Name of the Degree Programme – B.Tech. Electronics & Communication Engineering

Duration – Four years spread over 8 Semesters

Programme Objective – To produce conceptually sound and technically well equipped Electronics & Communication Engineers with excellent aptitude in functional comprehension and strong intent towards higher education & research who can successfully meet the ever changing national and global technological challenges.

Distribution of Credits for B.Tech. Electronics & Communication Engineering Programme

Courses	Number of Courses	Credits
Core	22	88
Department Elective	8	31
Open Elective	4	12
HR	2	4
Project	1	9
Lab	10	20
		164
I Year		61
TOTAL		**225**

SEMESTER – III

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA301 R01/ MCSCMA 301 R01	Engineering Mathematics - III	3	1	-	4	4
02.	BECCEC302 R01/ MCSCEC 302R01	Electric Circuit Theory	3	1	-	4	4
03.	BECCEC 303 R01/ MCSCEC 303 R01	Digital Electronics	4	-	-	4	4
04.	BECCEC 304 R02/ MCSCEC 304 R01	Electronic Circuits	3	1	-	4	4
05.	BECCEC 305 R01/ MCSCEC 305 R01	Signals and Systems	3	1	-	4	4
06.		**Department Elective I**	4	-	-	4	4
07.	BECCEC 306 R02/ MCSCEC 306 R01	Electronic Circuits Laboratory	0	-	3	3	2
08.	BECCEC 307 R01/ MCSCEC 307 R01	Digital Electronics Laboratory	0	-	3	3	2
		Total	20	4	6	30	28

List of Departmental Electives for III Semester

BECDEC 302R02 / MCSDEC 302R01 - Measurements and Instrumentation

BECDEC 305/ MCSDEC 305 - Materials Science

BECDEC 306 /MCSDEC306 - Device Physics

Additional courses specified for lateral entry students

			L	T	P	C
BECDEC 303R02	Programming in 'C'	-	3	1	0	4
BECDEC 304R01	Programming in 'C' Lab	-	0	0	3	2

S E M E S T E R – IV

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA 401R02/ MCSCMA 401R01	Engineering Mathematics - IV	3	1	-	4	4
02.	BECCEC 402 R02/ MCSCEC 402R01	Network Theory	3	1	-	4	4
03.	BECCEC 403R02/ MCSCEC 403R01	Linear Integrated Circuits	4	-	-	4	4
04.	BECCEC 404R02/ MCSCEC 404R01	Engineering Electromagnetics	4	-	-	4	4
05.	BECCEC 405R02/ MCSCEC 405R01	Analog Modulation and Systems	4	-	-	4	4
06.		**Department Elective II**	3	-	-	3	3
07.	BECCEC 406R02/ MCSCEC 406R01	Circuits and System Simulation Laboratory	0	-	3	3	2
08.	BECCEC 407 R01/ MCSCEC 407	Linear Integrated Circuits Laboratory	0	-	3	3	2
		Total	21	2	6	29	27

List of Departmental Electives for IV Semester:

BECDEC 401R01 / MCSDEC 401R01 – Pulse and Wave Shaping Circuits
BECDEC 404 / MCSDEC 404 – Electrical Engineering
BECDEC 405 / MCSDEC 405 – Java Programming

Additional courses specified for lateral entry students

			L	T	P	C
BECDEC407R02	Programming in 'C++'	-	3	1	0	4
BECDEC408R01	Programming in 'C++' Lab	-	0	0	3	2

S E M E S T E R – V

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA501 R01 / MCSCMA501 R01	Engineering Mathematics – V (Probability and Random Processes)	3	1	-	4	4
02.	BECCEC502 R02 / MCSCEC502 R02	Microprocessors	4	-	-	4	4
03.	BECCEC503 R01 / MCSCEC503 R01	Antenna and Wave Propagation	4	-	-	4	4
04.	BECCEC504 R01 / MCSCEC504 R01	Digital Communication	4	-	-	4	4
05.		**Department Elective III**	4	-	-	4	4
06.		**Department Elective IV**	4	-	-	4	4
07.	BECCEC505 R02 / MCSCEC505 R02	Microprocessors Laboratory	0	-	3	3	2
08.	BECCEC506 R01 / MCSCEC506 R01	Communication Laboratory	0	-	3	3	2
09.	BECCTP507 R02 / MCSCTP507 R01	HR Skills-I	2	-	-	2	2
		Total	25	1	6	32	30

List of Departmental Electives for V Semester

BECDEC501 R01 / MCSDEC501 R01 - Optical Communication

BECDEC505 R01 / MCSDEC505 R01 - Biomedical Instrumentation

BECDEC506 / MCSDEC506 - Virtual Instrumentation

BECDEC507 / MCSDEC507 - Television Engineering

BECDEC 508/MCSDEC508 - Power Electronics

S E M E S T E R – VI

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCEC 601R01 / MCSCEC 601R01	Microcontrollers	4	-	-	4	4
02.	BECCEC 602R01 / MCSCEC 602R01	Digital Signal Processing	3	1	-	4	4
03.	BECCEC 603 R01 / MCSCEC 603 R01	Microwave Engineering	4	-	-	4	4
04.	BECCEC 604 R01 / MCSCEC 604 R01	Control Engineering	4	-	-	4	4
05.		**Department Elective V**	4	-	-	4	4
06.		**Department Elective VI**	4	-	-	4	4
07.	BECCEC 605R01 / MCSCEC 605R01	Microcontroller Laboratory	0	-	3	3	2
08.	BECCEC 606 R01/ MCSCEC 606 R01	Microwave Laboratory	0	-	3	3	2
09.	BECCTP 607 R02 / MCSCTP 607 R01	HR Skills-II	2	-	-	2	2
		Total	25	1	6	32	30

List of Departmental Electives for VI Semester

BECDEC 602 R01 / MCSDEC 602 R01 - Satellite Communication

BECDEC 604 R01 / MCSDEC 604R01 - Real Time Operating System (RTOS)

BECDEC 605 R01 / MCSDEC 605 R01 - Neural Networks and Fuzzy Logic

BECDEC 606 / MCSDEC 606 - RADAR Engineering

SEMESTER - VII

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCEC 701R01/ MCSCEC 701R01	Information Theory and Coding	4	-	-	4	4
02.	BECCEC 702 R01/ MCSCEC702 R01	VLSI Design	4	-	-	4	4
03.	BECCEC 703R01/ MCSCEC703R01	Signal Processing Architectures and Algorithms	4	-	-	4	4
04.	BECCEC 704 R01/ MCSCEC704R01	Wireless Communication	4	-	-	4	4
05.		**Department Elective VII**	4	-	-	4	4
06.		**Department Elective VIII**	4	-	-	4	4
07.	BECCEC 705R01/ MCSCEC705R01	HDL Programming Laboratory	0	-	3	3	2
08.	BECCEC 706R01/ MCSCEC706R01	DSP Laboratory	0	-	3	3	2
		Total	24	-	6	30	28

List of Departmental Electives for VII Semester

BECDEC 701 R01 / MCSDEC 701 R01 – Image Processing

BECDEC 702 R01 / MCSDEC 702 R01 – Speech Processing

BECDEC 703 R01 / MCSDEC 703R01 – Computer Networks

BECDEC 704 R01 / MCSDEC704R01 – Spread Spectrum Communication

BECDEC 705 R01 / MCSDEC705R01 – Computer Communication

BECDEC 706 R01 / MCSDEC706R01 – Telecommunication Switching, Traffic and networks

BECDEC 707 R01 / MCSDEC707R01 – Communication Protocols

BECDEC 708 R01 / MCSDEC708R01 – Advanced Communication Networks

BECDEC 709 R01 / MCSDEC709R01 – Embedded Systems

BECDEC 710 / MCSDEC710 – Radio Navigation Systems

BECDEC 711 / MCSDEC711 – Hardware Design with Bluespec System Verilog

Scheme of Study and Syllabi for III Semester of

B.Tech. Electronics & Communication Engineering Programme
(Common with)
M.Tech. Communication Systems (5 -Year Integrated) Programme

S E M E S T E R – III

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA301 R01/ MCSCMA 301 R01	Engineering Mathematics - III	3	1	-	4	4
02.	BECCEC 302 R01/ MCSCEC 302R01	Electric Circuit Theory	3	1	-	4	4
03.	BECCEC 303 R01/ MCSCEC 303 R01	Digital Electronics	4	-	-	4	4
04.	BECCEC 304 R02/ MCSCEC 304 R01	Electronic Circuits	3	1	-	4	4
05.	BECCEC 305 R01/ MCSCEC 305 R01	Signals and Systems	3	1	-	4	4
06.		Department Elective I	4	-	-	4	4
07.	BECCEC 306 R02/ MCSCEC 306 R01	Electronic Circuits Laboratory	0	-	3	3	2
08.	BECCEC 307 R01/ MCSCEC 307 R01	Digital Electronics Laboratory	0	-	3	3	2
		Total	20	4	6	30	28

List of Departmental Electives for III Semester

BECDEC 302R02 / MCSDEC 302R01 - Measurements and Instrumentation

BECDEC 305/ MCSDEC 305 - Materials Science

BECDEC 306 /MCSDEC306 - Device Physics

Additional courses specified for lateral entry students

		L	T	P	C
BECDEC 303R02 Programming in 'C'	-	3	1	0	4
BECDEC 304R01 Programming in 'C' Lab	-	0	0	3	2

COURSE CODE : BECCMA301 R01 / MCSCMA 301R01
COURSE NAME : ENGINEERING MATHEMATICS - III
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To help the learners in understanding various transform techniques used in Engineering disciplines and Analytic function theory in engineering computations**.**

UNIT – I: Laplace Transforms : 15 PERIODS

Laplace transforms – definition – Conditions for existence – Transform of standard functions – Properties – Transform of derivatives and integrals – Derivatives and integrals of transforms. Inverse Laplace transforms – Convolution theorem – transform of periodic functions, unit step function and unit impulse (or dirac delta) function.

Applications to solve higher order ordinary differential equations and Simultaneous differential equations with constant coefficients and integro- differential equations. Simple Engineering Applications: Bending of Beams, Whirling of Shafts and Electric Circuits.

UNIT – II: Complex Differentiation: 15 PERIODS

Analytic functions – Necessary conditions for analyticity – Cauchy- Riemann equations in cartesian and polar coordinates – Sufficient conditions for analyticity (without proof) – Properties of analytic functions: Harmonic functions – Orthogonal system – Construction of an analytic function when its real or imaginary part is given – Conformal mappings - $e^z, \sin z, \cos z, z+\frac{1}{z}$ and $\sinh z$ only – Bilinear Transformation. Simple Engineering applications: Complex potential functions, Stream lines, equipotential , velocity potential and stream functions.

UNIT – III: Complex Integration: 15 PERIODS

Complex integration –Line and Surface Integrals- Cauchy's integral theorem – Integral formula – Taylor's and Laurent's series (without proof) – Singularities – Zeros – Poles and residues – Cauchy's residue theorem – Contour integration – evaluation of integrals of the type $\int_0^{2\pi} f(\sin\theta, \cos\theta)d\theta$ *and* $\int_{-\infty}^{\infty} \frac{f(x)}{g(x)}dx$ only.

UNIT – IV : Fourier Transforms: 15 PERIODS

The infinite Fourier transforms – Sine and cosine transforms – properties – Inversion theorem – problems – Convolution theorem – Parseval's identity – Problems – Finite Fourier transforms – Sine and cosine transforms – Evaluation of definite Integrals-problems Solving boundary value problems using finite Fourier sine and cosine transforms.

Text Books:

1. Engineering Mathematics (For Semester III) by T.Veerarajan ,Tata Mcgraw - Hill Publishers LTD, New Delhi - 2010
2. Engineering Mathematics, Part A, Dr. M.K.Venkataraman, National publishing company, 2004.

Suggested Readings:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers, 2006.
2. Advanced Engineering Mathematics, J.Erwin Kreyszig, 8th edition, Wiley eastern Ltd., 2007.
3. Advanced engineering mathematics, Jain R.K and S.R.K. Iyengar, Narosa publications, 2006.

Learning Outcomes:

Unit – I	The learner will have knowledge to use the transform techniques in other fields of Engineering such as Signal and Image processing and also to transform functions from one domain to another domain.
Unit – II	The learner will be able to apply various concepts in Analytic Function Theory in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
Unit – III	The learner will be capable of evaluating complicated integrals using residue calculus.
Unit – IV	The learner will have a strong idea of applying Fourier transform techniques in solving boundary and initial value problems in various branches of Engineering.

COURSE CODE : BECCEC302 R01 / MCSCEC 302R01
COURSE NAME : ELECTRIC CIRCUIT THEORY
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the intricacies of one & two port networks through the basic theorems of network, concepts of transients, series and parallel resonance.

UNIT – I: Circuits and Introduction to Graph Theory: 12 PERIODS

Voltage Division and Current Division Rule – Kirchoff's Voltage and Current Law-Mesh and Nodal Analysis for DC and AC Circuits – Dependent and Independent Sources-Super-Mesh and Super Node Analysis – Star-Delta Transformation-Source Transformation.

Concept of network graph – definitions of terminology – Analysis of network by current basis – Analysis of network based on Voltage – Incidence and loop matrix-Tie set – Cut set.

UNIT – II: Network Theorems: 12 PERIODS

Thevenin's Theorem – Norton's Theorem – Superposition Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem – Substitution Theorem – Compensation Theorem – Millman's Theorem – Tellegen's Theorem – Both for DC and AC Circuits.

UNIT – III: Transients, Resonance & Coupled Circuits: 24 PERIODS

Initial Conditions in Elements – RL Circuit - Growth of Current-Decay of Current-RC Circuit-Charging of a Capacitor-Discharging of a Capacitor – Transient Response of RLC Circuits-Over Damped, Critically Damped and Under Damped Conditions – DC and AC with Sinusoidal Input (Using Laplace Transform Technique)

Series Resonance-Bandwidth-Quality Factor-Voltage Magnification in Resonance – Frequency for Maximum Values of Voltage Across Inductor and Capacitor – Parallel Resonance – Resonant Frequency of Tank Circuit and Other Parallel Combinations – Q Factor – Bandwidth a Parallel Resonant Circuit.

Self Inductance – Mutual Inductance – Dot Convention – Co-efficient of Coupling – Series and Parallel Connection of Coupled Coils – Analysis of Coupled Circuits.

UNIT – IV: One and Two Port Networks: 12 PERIODS

One Port – Driving Point Impedance and Admittance – Two Port Parameters: Relationship of Two Port Variables – Short Circuit Admittance Parameters – Open Circuit Impedance Parameters – Transmission Parameters – Hybrid Parameters – Relationship Between Parameter Sets - Condition for Symmetry – Condition for Reciprocity – Interconnection Two Port Networks.

Text Books:

1. M.E. Van Vakenburg – " Network Analysis:, Third edition, Prentice Hall of India, 2009.
2. W.H. Hayt and J.E Kemmerley, S.M. Durbin – "Engineering Circuits Analysis", Sixth edition. McMillian & McGraw Hill 2006.

Suggested Readings:

1. Smarajit Ghose – "Network Theory", Prentice Hall of India, 2005.
2. A. Sudhakar and Shyammohan – "Circuits and Networks – Analysis and Synthesis" Second edition, Tata McGraw-Hill, 2002.
3. U.A Bakshi, A.V. Bakshi – "Network Analysis and Synthesis" First edition, Technical Publications, 2002.
4. NPTEL Link – http://www.youtube.com/playlist?list=PL1D46B10238154408.

Learning Outcomes:

Unit – I	Students will have an understanding of the passive circuit elements like resistors, capacitors, inductors in addition to voltage & current sources. Students will be able to solve simple circuits based on the fundamentals laws namely KCL and KVL
Unit – II	Students can systematically analyze simple circuits by adapting various network theorems.
Unit – III	Students will have a clear understanding of the resonance & transient response concept and they can solve problems related to networks and transient response of series and parallel RL, RC and RLC circuits
Unit – IV	Students will be able to solve one & two port network problems on employing all the concepts provided in the first three units.

COURSE CODE : BECCEC303 R01 / MCSCEC 303R01
COURSE NAME : DIGITAL ELECTRONICS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To design and analyze various combinational and sequential class of simple and complex logic circuits in-turn to provide a strong foundation to learn courses like Microprocessors, Microcontrollers and VLSI Design.

UNIT – I: Boolean Simplification & Logic Families: 15 PERIODS

Boolean Functions: Boolean Laws- Simplifications Using Laws- Minterms- Maxterms- Sum of Product and Product of Sum Forms – Karnaugh Map – NAND, NOR Implementation.
Digital Logic families: RTL- DTL – ECL – TTL – CMOS Logic Families- Characteristics - Comparison of IC Families

UNIT – II: Logic Design, PLDS & Memories: 15 PERIODS

Combinational Circuits: Adders – Subtractors - Magnitude Comparators - Multiplexer - Demultiplexer - Encoder - Decoder.
Memories: Semiconductor Memories – Types of Memories: RAM, ROM, EPROM, EEPROM,MRAM,CAM, CCD,Flash Memory
Programmable Devices: SPLD: PAL, PLA, GAL, PROM, CPLD,FPGA

UNIT – III: Asynchronous Sequential Machine: 15 PERIODS

ASM: Introduction - ASM Charts- Examples of Synchronous Sequential Network Design Using ASM Charts- State Assignment- ASM Tables- ASM Realization for Traffic Control, 2 Bit Synchronous Up/Down Counter, Automatic Bank Teller, Milk Vending Machine, Waveform Generator.

UNIT – IV: Asynchronous & Synchronous Sequential Circuits: 15 PERIODS

Sequential Circuits: Flip Flops: RS- D- JK- T and Master Slave Flip Flops.
Registers: Shift Registers- SISO, SIPO, PISO, PIPO and Bi-Directional Registers
Counters : Design of Synchronous Counters, Design of Asynchronous Counters FSM - Basic Design Procedure - Mealy & Moore Machines - FSM realization Design of Sequential Networks –ROM , PLA ,PLDs and PGAs

Text Books:

1. M.Morris Mano - "Digital Design", Fourth Edition, Pearson Education, 2011.
2. Charles H.Roth,Jr - "Fundamentals of Logic Design", Fifth edition, Thomson. 2007.
3. Donald D. Givone - "Digital Principles and Designs", TMH, 2003.

Suggested Readings:

1. R.P.Jain - "Modern Digital Electronics", Fourth Edition, TMH, 2011.
2. T.L.Floyd - "Digital Fundamentals", Tenth Edition, Pearson Education, 2011.
3. NPTEL Link – http://www.youtube.com/playlist?list=PLF322552FBCA61BA7.

Learning Outcomes:

Unit – I	Students will have a basic knowledge on the laws of binary logic as well as they will have an understanding of the various digital logic families
Unit – II	Students can design various combinational logic circuits, memories and programmable logic devices
Unit – III	Students will be capable of designing asynchronous state machines.
Unit – IV	Learners will be able to design various synchronous and asynchronous sequential circuits and they can develop finite state machines

COURSE CODE : BECCEC304 R02 / MCSCEC 304 R01
COURSE NAME : ELECTRONIC CIRCUITS
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To provide the principle and operations of the basic building blocks like BJT & MOSFET of electronic circuits and to design different types of amplifiers, oscillators, etc.

UNIT – I: Biasing of BJT & FET: 14 PERIODS

Selection of Operating Point for BJT- DC Load Line – BJT: Types of Biasing - Bias Stabilization – Bias compensation – FET: Types of Biasing – MOSFET: Types of Biasing

UNIT – II: Small Signal Analysis and Frequency Response of BJT & FET: 16 PERIODS

Small signal analysis: Classifications of Amplifier - Common emitter amplifier, Common base amplifier, Emitter follower: r_e model, h parameter – hybrid π model – Multistage amplifier- Cascade connection, Cascode connection.
FET: Small signal model:Common source – Common drain –Commom Gate
MOSFET amplifier: Graphical analysis and small signal parameters, small signal equivalent circuit – Common Source amplifier
Frequency response
Frequency analysis of RC coupled amplifier: BJT – Miller effect

UNIT – III: Feedback Amplifiers and Oscillators: 14 PERIODS

Feedback concepts – Feedback connection types – Feedback amplifiers – Merits and demerits.

Oscillators-principle of operation – Phase shift – Wein Bridge – Crystal – LC Oscillators using BJT-UJT Relaxation Oscillator

UNIT – IV: Tuned Amplifiers and Power Amplifiers: 16 PERIODS

Tuned Amplifier: Single Tuned - Double Tuned- Stagger tuned.
Power amplifiers: Working principle of Class A, Class AB, Class B, Class C, Class D and Class S amplifiers.-efficiency of class A, Band C amplifiers.

Text Books:

1. Theodore Bogart. Jr, Jefrey S.Beasely, Guilermo Ricco - “Electronic Devices and Circuits” Pearson, Sixth edition, 2012.
2. G.K.Mithal -”Electronic Devices and Circuits”, Twenty Third Edition, Khanna publishers 2010.
3. Robert L. Boylestad & Lousis Nashelsky- “Electronic devices & Circuit Theory”, Pearson education, Tenth edition, 2009.
4. Donald A Neamen - “Electronic Circuit Design and Analysis”, Third edition, TMH, 2009.

Suggested Readings:

1. Millman J, Halkias C.C - "Electronic Devices and Circuits" TMH, 2011.
2. J.B.Gupta - "Electronic Devices and Circuits", Third edition, S.K.Kataria and sons, 2011.
3. Schilling and Belove - " Electronic Circuits-Discrete and Integrated", Third edition, McGraw Hill, 2002.
4. NPTEL Link – http://www.youtube.com/playlist?list=PL4C141B35706AD19A.

Learning Outcomes:

Unit – I	The learner will have an understanding of the concepts of biasing of BJT, FET, MOSFET and various stabilization techniques. They will be able to apply the concept to design various biasing circuits.
Unit – II	The learner will be able to analyze the small signal models of BJT and FET and know how the circuit responds to low and high frequency input signals
Unit – III	The learner will be able to design negative and positive feedback circuits, elucidate the working of different oscillators for any given frequency.
Unit – IV	The learner will have an understanding of the basic function of power and tuned amplifiers and can design tuned and power amplifier for a given specification.

COURSE CODE	**: BECCEC 305R01 / MCSCEC 305R01**
COURSE NAME	**: SIGNALS AND SYSTEMS**
LECTURE PERIODS PER WEEK	**: 03**
TUTORIAL PERIOD PER WEEK	**: 01**
TOTAL PERIODS PER WEEK	**: 04**
CREDITS	**: 04**

Course Objective:

- To understand the intricacies of continuous, discrete signals and systems
- To learn to represent signals in spatial and frequency domains
- To understand the significance of designing systems with specific impulse response in-turn to design digital filters

UNIT – I: Introduction to Signals and Systems: **14 PERIODS**

Definition of Signal and System – Classification of Signals – Continuous–Time, Discrete Time – Even and Odd – Periodic and Non Periodic – Deterministic and Random – Energy and Power – Basic Operations on Dependent and Independent Variables of Signal – Elementary Signal – Exponential, Sinusoidal, Step, Impulse and Ramp – Properties of System – Stability, Memory, Causal, Invertibility, Time Invariant and Linearity. Non causal systems –Examples-Need for Trasnformation techniques (concepts)

UNIT – II: Linear Time Invariant System: **18 PERIODS**

Introduction – Discrete Time Linear Time Invariant Systems - Representation of Discrete Time Signals in Terms of Impulses – The Convolution Sum - Continuous–Time Linear Time Invariant Systems - Representation of Continuous Signals in Terms of Impulses – The Convolution Integral — Properties of Linear Time Invariant Systems – The Unit Step Response of Linear Time Invariant System - System Characterization by Linear Constant Coefficient Differential Equations and Difference Equations.

UNIT – III: Representation of Periodic Signals by Fourier Series and by Samples:

14 PERIODS

The Response of LTI Systems to Complex Exponentials – Continuous Time Periodic Signals – Convergence of Fourier Series – Properties of CTFS.
Discrete Time Periodic Signals – Properties of DTFS - Representation of Continuous Time Signals by its Samples:-Sampling Theorem, Impulse – Train Sampling, Sampling with a Zero Order Hold – Reconstruction of a Signal from its Samples using Interpolation – The Effect of Under Sampling – Aliasing – Sampling of Discrete Time Signals – Discrete Time Decimation & Interpolation

UNIT – IV: Fourier Transform and Z Transform **14 PERIODS**

Continuous Time Fourier Transform (CTFT) for Aperiodic and Periodic Signals – Properties – Discrete Time Fourier Transform (DTFT) for Aperiodic and Periodic Signals – Properties - Parseval's Relations for CTFT and DTFT. Definition for Z Transform-Region of Convergence-Z Transform for basic functions(Step, Ramp, Sinusoidal and Exponential Function)-Properties of Z transforms-Inverse Z Transforms(Partial Fraction)

Text Book:

1. Alan V. Oppenheim and Alan S. Willsky with S. Hamid Nawab -"Signals and Systems",Pearson Education, Second edition, 2008.

Suggested Readings :

1. B. P. Lathi - "Linear Systems & Signals", Second edition, Oxford University press, 2009.
2. Simon Haykin and Baray Van Veen -"Signals and Systems", Wiley and sons, Second edition, 2008.
3. Seymour Lipschutz and Marc Lipson- "Schaums outline of Linear Algebra", Third edition, Tata McGraw - Hill, 2002.
4. Ziemer and Tranter - "Signals and Linear Systems", Second edition, Maxwell McMillan, 2001.
5. NPTEL Link 1 – http://www.cdeep.iitb.ac.in/nptel/ Electrical%20 %26 %20 Comm % 20 Engg / Signals%20and%20System/Course_home.html.
6. NPTEL Link 2 – http://www.youtube.com/playlist?list=PL75A2863DF4CE1CE6.

Learning Outcomes:

Unit – I	The learners will have an understanding of mathematical representation and classifications of signals and systems.
Unit – II	The learner will be able to understand the behaviour of continuous time and discrete time systems in terms of convolution integral and convolution sum. In addition, the students will be able to describe the continuous time system by constant coefficient differential equation and discrete time system by constant coefficient difference equations.
Unit – III	The learner will be able to understand the representation of periodic CT and DT signals by Fourier series. The students will be able to know the needs of the sampling process
Unit – IV	The learner will have an understanding of the representation of periodic and aperiodic, continuous time and discrete time signals by Fourier transforms. Also the learners will able to analyse the discrete time systems using z-transforms.

COURSE CODE : BECDEC 302 R02 / MCSDEC 302R01
COURSE NAME : MEASUREMENTS AND INSTRUMENTATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the intricacies of measurement characteristics and various associated standards.
- To provide an insight into the working principle and characteristics of analog and digital instruments utilized for various measurement applications.

UNIT – I: Basic Measurement Concepts: 15 PERIODS

Measurements – Static and Dynamic Characteristics - Significance – Concept of Direct and Indirect Measuring Methods – Significant Figures – Statistical Analysis - Types of Errors – Dimensions and Dimensional Equations – Classification of Standards – Classification of Instruments – Absolute and Secondary Type – Deflection and Null Type- AC bridges and their Applications. .

UNIT – II: Transducers and Electronic Instruments: 15 PERIODS

Transducers – Types: Potentiometer, Displacement, Strain Gauge, Thermocouple, Photometric, Photo resistors, RTD, Thermistors, Resistance thermometer, Electro-acoustic and Piezo-Electric Transducers – Optical Sensors.
Electronic Instruments: DC and AC meters, True- RMS Voltmeter, Multimeter, Q-Meter, pH Meter. Fiber Optics Measurements-Pressure, Temperature, Flow Level

UNIT – III: Digital Instrumentation: 15 PERIODS

Digital Instruments – Advantages – Resolution, Sensitivity and Accuracy Specifications for Digital Meters.
Basic digital counter – Frequency Measurement – Frequency Ratio Measurement – Period Measurement – Time Interval Measurement – Pulse Width Measurement – Digital Voltmeters – Basic Principles – Vector Voltmeter - Digital Multimeter.

UNIT – IV: Display Devices, Recorders and Analyzers: 15 PERIODS

LED – Multisegment LED display – LCD – Plasma Display - Oscilloscope – CRT – Focusing and Deflection systems – Screens for CRT – Delay line – Multiple Trace – Storage and Sampling Oscilloscopes. Recorders - PDM, Digital Tape.
Fundamentals of Spectrum Analyzer, Wave Analyzer, Harmonic Distortion Analyzer, Network Analyzer, Logic Analyzer, MRI and CT scanners.

Text Books:

1. H.S.Kalsi - "Electronic Instrumentation "-TMH, Third edition, 2010.
2. Helfrick and Cooper – "Electronic Instrumentation and Measurement Techniques" PHI, 2009.
3. A.K. Sawhney – "Electrical and Electronic Measurements and Instrumentation" – Dhanpat Rai and Co., 2008.

Suggested Readings :

1. Leslie Cromwell, Fred J. Werbell and Eruch A. Pfeiffer – "Biomedical instrumentation and Measurements" – Second edition, PHI, 2011.
2. A.J. Bouwens – "Digital Instrumentation" – TMH, 2004.
3. S. M. Dhir – "Applied Electronics and Instrumentation" – TMH, 2002.
4. NPTEL Link – http://www.youtube.com/watch?v=nv3GuJArjNU

Learning Outcomes:

Unit – I	The learners will be able to understand the basic measurement concepts, static and dynamic characteristics, classification of the measuring instruments and their working principles.
Unit – II	The learners will have an insight into the various types of transducers and working principles of industrial instruments.
Unit – III	The learners will have an understanding of different digital instruments for various measurement techniques.
Unit – IV	The learners will have an understanding of the significance of display units, recorders and will be able to comprehend the working principle of various data analyzers.

COURSE CODE	**: BECDEC 305 / MCSDEC 305**
COURSE NAME	**: MATERIALS SCIENCE**
LECTURE PERIODS PER WEEK	**: 04**
TOTAL PERIODS PER WEEK	**: 04**
CREDITS	**: 04**

Course Objective:

- To understand the electrical, dielectric, magnetic, thermal properties of materials
- To understand the applications of materials based on their properties

UNIT – I: Electrical Materials: **15 PERIODS**

Classical Free Electron Theory – Success and Breakdown; Quantum Theory - Electrons in Metal – Fermi Energy and Density of States, Electron in a Periodic Potential – Kronig-Penney Model.
Contact Potential - Seebeck, Peltier and Thomson effect - Thermoelectric Generator; Materials for Electric Resistances, Brushes of Electric Machines, Lamp Filaments, Fuses and Soldering.

UNIT – II: Dielectric Materials: **15 PERIODS**

Types of polarization - Local Field – Clausius-Mosotti Equations; Dielectric Loss, Loss Tangent and Breakdown; General Properties of Dielectric Materials, Frequency and Temperature Dependence of Dielectric Properties; –Behaviour of Dielectrics Under Static and Alternating Fields – Complex Dielectric Constant – Dielectric Relaxation.
Active (Ferroelectric, Piezoelectric and Pyroelectric Materials) and Passive Dielectric Materials, Classification of Electrical Insulating Materials – FRLS Cable and XLPE Materials.

UNIT – III: Magnetic Materials **15 PERIODS**

Origin of Permanent Magnetic Dipoles, Different Types of Magnetic Materials, Curie-Weiss Law, Langevin's Theory for Diamagnetic and Paramagnetic Materials, Weiss Theory of Ferromagnetism, Domain Theory of Ferromagnetism, BH Curve and Hysteresis Loop, Hard and Soft Magnetic Materials-Applications. Magnetic Recording Materials, Magnetic Principle of Analog Recording and Reading, Magnetic Bubble Memory, Magnetic Computer Hard Disc, Magnetic Materials used in Electrical Machines

UNIT – IV: Advanced Materials: **15 PERIODS**

General Properties and Types of Superconducting Materials, Bardeen, Cooper and Schrieffer Theory, Electron-Phonon Interaction, High Temperature Superconductor.
Classification of Optical Materials, Traps, Excitons and Colour Centres; Luminescence-Classification. Classification, Structure and Properties of Advanced Ceramics and Polymers;
Nonlinear Materials – Basic Principle and Classification - Second Harmonic Generation; Metamaterials –Properties

Text Books:

1. D. William and Callister, Jr.-"Materials Science and Engineering-An Introduction", Eighth edition,John Wiley & Sons, Inc. 2010.
2. J.M. Martínez-Duart, R.J. Martín-Palma, Agulló-Rueda -"Nanotechnology for Microelectronics and Optoelectronics" Elsevier Inc., 2006.

3. Christophe Caloz, Tatsuo Itoh -"Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications" Wiley-Inter Science Publication, 2006.

Suggested Readings:

1. B.S. Saxena, R.C. Gupta, P.N. Saxena,-"Fundamentals of Solid State Physics"- Twelveth Edition, Pragai Prakashan, Meerut, 2008.
2. James D. Patterson and Bernard C. Bailey - "Solid-State Physics: Introduction to the Theory", Springer-Verlag Berlin, Heidelberg, 2007.
3. A. J. Dekkar - "Electrical Engineering Materials", Nineteenth edition, Prentice Hall,1997.
4. NPTEL Link 1 – http://freevideolectures.com/Course/2266/Material-Science.

Learning Outcomes:

Unit – I	The learner will have an understanding of electron theory and various effects in designing electrical components.
Unit – II	The learner will be able to apply the theory of polarization to understand the behavior of dielectric material under electric fields.
Unit – III	The learner will have an understanding of the origin of magnetism and theory for different magnetic materials. Also, the learner will be able to apply the theory in understanding magnetic recording materials.
Unit – IV	The learner will be able to know the property and theories of different new materials such as high temperature superconductor, non linear materials and meta materials.

COURSE CODE : BECDEC 306 / MCSDEC306
COURSE NAME : DEVICE PHYSICS
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIODS PER WEEK : 01
TOTAL PERIOD PER WEEK : 04
CREDITS : 04

Course Objective:

To develop a deep understanding of physics of semiconductors and their operation so that materials, device types and device performance can be correlated. To understand the association of performance parameters with underlying semiconductor properties and physical principles is the prime importance of the course.

This course will serve as a pre-requisite for the courses Electronic Circuits, VLSI design, Power electronics and Pulse and Wave Shaping Circuits.

UNIT-I: Introduction to Semiconductor: 15 PERIODS

Crystalline Structure of Semiconductors - Electron wave function - Unit cell concept, Simple 3D unit cells, Semiconductor lattices, Miller indices - One dimensional crystals - Three dimensional crystals - Band structures - Intrinsic semiconductors - Extrinsic semiconductors - Density of states - Fermi function - Electron and hole concentration, np product, carrier concentration calculations, Fermi level determination
Current flow - Drift, Diffusion - Carrier generation and recombination - Continuity equations - Minority carrier lifetime - Quasi fermi level - Einstein relation.

UNIT– II: PN Junction and Diodes : 15 PERIODS

Energy band diagrams - Current flow in a pn junction - Energy band diagram at equilibrium and bias for step junction - Current-voltage characteristics -Non-ideal characteristics - Small signal admittance - Junction capacitance - Zener & Schottky diodes - Ohmic & schottky contacts.

UNIT– III: Bipolar Transistor and MOSFET devices: 15 PERIODS

Physics of operation of BJT, Performance parameters of BJT, Ideal transistor analysis- Ebers-Moll dc model - Current crowding & base resistance - Early effect - Avalanche breakdown - High injection - Kirk effect - Recombination - Frequency response.
Physics of operation of MOSFET - Flat band and threshold voltage, I_d-V_g derivation, MOS capacitors - MOSFET at equilibrium and non-equilibrium - Short channel effects.

UNIT–IV: Special devices : 15 PERIODS

Photodiodes - pn junction photodiode, Types of photodiodes - Solar cells - Solar cell basics, efficiency considerations - Solar cell technologies - LEDs - Types of LEDs - Working of LEDs, Laser diodes - Structures - Laser action.

Text Books:

1. Betty Anderson and Richard Anderson, Fundamentals of semiconductor devices, McGraw Hill Education (India) Private Limited, 2013.
2. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education, 2011

Suggested Readings:

1. M.S. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley India Private Limited, 2008.
2. S.M. Sze, Physics of semiconductor devices, Wiley India Private Limited, 2008.
3. Pallab Bhattacharya, Semiconductor optoelectronic devices, Prentice Hall, 2002.
4. NPTEL Link – http://www.cdeep.iitb.ac.in/nptel/Core%20Science/Engineering%20Physics%202/TOC M6.htm
5. NPTEL Link – http://nptel.ac.in/syllabus/115102025/
6. NPTEL Link – http://nptel.ac.in/syllabus/115102026/

Learning outcomes:

Unit – I	Students will have an understanding of the concepts of band structure, intrinsic/extrinsic semiconductors, electrons, holes and able to derive drift-diffusion current and Einstein equations.
Unit – II	Students will have an understanding of the generation/recombination and the physics of pn junction diode.
Unit – III	Students will have an understanding of the different types of Bipolar transistor and field effect devices and their physics.
Unit – IV	Students will have an understanding of the operation of different optoelectronic devices like photodiodes, solar cells, LEDs and laser diodes.

COURSE CODE : BECCEC 306R02 / MCSCEC 306R01
COURSE NAME : ELECTRONIC CIRCUITS LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

- To understand the basic V - I characteristics of various active devices
- To design electronic circuits with difference frequency response characteristics

List of Experiments

1. Q point calculation of emitter feedback, collector feedback and voltage divider bias using BJT.
2. Frequency response characteristics of RC coupled amplifier using BJT.
3. Frequency response characteristics of direct coupled amplifier using BJT.
4. Frequency response of CC amplifier
5. Transistor, FET and MOSFET as a switch.
6. Differential amplifier using FET or BJT
7. Frequency response of current series amplifier (with and without feedback)
8. Frequency response characteristics of single tuned amplifier
9. Frequency response characteristics of Complementary symmetry push-pull amplifier.
10. Audio frequency oscillator for a specified frequency of oscillation.
11. Relaxation oscillator using UJT
12. Frequency response characteristics of cascode amplifier

Learning Outcomes:

Expt. No	Outcome
1.	The learners will be able to design various biasing and feedback circuits for a given specification and they can troubleshoot them.
2.	The learners will be able to design the RC coupled amplifier circuit for a desired frequency response.
3.	The learners will be able to design a direct coupled amplifier circuit for the desired gain characteristics
4.	The learners will be able to design a emitter follower circuit for a desired frequency response.
5.	The learners will be able to design switches using BJT, FET and MOSFET
6.	The learners will be able to design differential amplifier using BJT and FET
7.	The learners will be able to design a current series amplifier circuit and will know how the circuit will respond with and without feedback for a given excitation.
8.	The learners will be able to design single tuned amplifier circuit for a specific Q factor and bandwidth.
9.	The learners will be able to design a complementary symmetry push pull amplifier and know how the circuit responds to a given excitation
10.	The learners will be able to design an AFO for any given frequency.
11.	The learners will be able construct and design a relaxation oscillator.
12.	The learners will be able to design a cascode amplifier circuit and know how the circuit responds to a given excitation.

COURSE CODE : BECCEC 307R01 / MCSCEC 307R01
COURSE NAME : DIGITAL ELECTRONICS LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To understand and design various combinational and sequential logic circuits, memories and in-turn to assemble a 4 bit processor.

List of Experiments

1. Arithmetic Circuit- Construction and Testing using 74xx ICs
   (i) Half adder and Full adder.
   (ii) Half subtractor and Full subtractor.
2. Decoders with 7 segment display.
3. Combinational Logic Circuit Design using 74xx ICs
4. Four bit (Modulo 16) Adder / Subtractor
5. Construction of 1- bit Comparator-using 74xx and study of 4 bit Comparator IC 7485.
6. Multiplexer and Demultiplexer
7. Arithmetic Logic Unit
8. Verification of various flip-flops using gates.
9. Construction of 3 bit Asynchronous Ripple Counter.
10. Shift Register – SIPO/SISO & PIPO/PISO
11. Register file, instruction and data memories.
12. Assembling the Processors.

Learning Outcomes:

Expt. No.	Outcome
1.	Learners will be able to design adders and subtractors using ICs
2.	Learners will be able to design decoders with a 7 segment display
3.	Learners will be able to design various combinational circuits with 74xx ICs
4.	Learners will be able to design four bit modulo 16 adder and subtractor.
5.	Learners will be capable of designing a 1-bit comparator using 74xx IC and analyze 4-bit comparator using IC 7485.
6.	Learners will be able to design multiplexer and demultiplexer using ICs
7.	Learner will be able to design an arithmetic and logic unit
8.	Learners will be able to analyze and verify the output of various flip-flops with gates
9.	Learners will be able to design 3-bit asynchronous ripple counter
10.	Learners will be able to design shift registers of various configurations like Serial-in Parallel-out (SIPO), Serial-in Serial-out (SISO), Parallel-in Parallel-out (PIPO) and Parallel-in Serial-out (PISO)
11.	Learners will be able to design registers and memories
12.	Learners will be able to assemble processors, which will contain all the combinational and sequential circuits designed in the prior practical classes

COURSE CODE : BECDEC303 R02
COURSE NAME : PROGRAMMING IN 'C'
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To help the learners understand the basic elements of programming languages and to develop the problem solving skills in the 'C' programming language.

UNIT – I: 15 PERIODS

Introduction to Computer Problem Solving: Introduction-Problem solving aspect, top down design, implementation of algorithms, program verification, efficiency and analysis of algorithms.
Designing Programs (Illustrations must be in C language): Understanding the programs purpose, examples, body, and testing and domain knowledge.
Variables, Data Types, and Arithmetic Expressions: Working with Variables, Understanding Data Types and Constants, Working with Arithmetic Expressions.
Program Looping: for Statement, while Statement, do Statement.
Making Decisions: if Statement, switch Statement, Boolean Variables, Conditional Operator.
Applications: counting, summing a set of numbers, finding factorial, sine function computation, reversing the digits of an integer, base conversion, character to number conversion.

UNIT – II: 15 PERIODS

Working with Arrays: Defining an Array, Initializing Arrays, Character Arrays, Multidimensional Arrays, Variable-Length Arrays.
Working with Functions: Defining a Function, Arguments and Local Variables, Returning Function Results, Functions Calling Functions, Functions and Arrays, Global Variables, Automatic and Static Variables, Recursive Functions.
Applications of Arrays and Functions: Removal of duplicates from an ordered array, partitioning an array, sorting by diminishing increment, binary search, keyword searching in a text, stack operation, computing the prime factors of an integer.

UNIT – III: 15 PERIODS

Working with Structures: A Structure for Storing the Date, Functions and Structures, Initializing Structures, Arrays of Structures, Structures Containing Structures, Structures Containing Arrays, Structure Variants.
Character Strings: Arrays of Characters, Variable-Length Character Strings, Escape Characters, More on Constant Strings, Character Strings, Structures, and Arrays, Character Operations.
Pointers: Defining a Pointer Variable, Using Pointers in Expressions, Working with Pointers and Structures, The Keyword const and Pointers, Pointers and Functions, Pointers and Arrays, Operations on Pointers.
Operations on Bits: Bit Operators, Bit Fields.
The Preprocessor: The #define Statement, The #include Statement, Conditional Compilation.
More on Data Types: Enumerated Data Types, The typedef statement, Data Type Conversions.
Applications of structures, character strings and pointers: Left and right justification of text, text line editing, linked list search, linked list insertion and deletion.

UNIT – IV: **15 PERIODS**

Working with Larger Programs: Dividing a Program into Multiple Files, Communication between Modules, Other Utilities for Working with Larger Programs.
Input and Output Operations in C: Character I/O: getchar and putchar, Formatted I/O: printf and scanf, Input and Output Operations with Files, Special Functions for Working with Files.
Miscellaneous and Advanced Features: Miscellaneous Language statements, Working with Unions, The Comma Operator, Type Qualifiers, Command-Line Arguments, and Dynamic Memory Allocation.
Debugging Programs: Debugging with the Preprocessor, Debugging Programs with gdb.
Application of file I/O: creation and processing of text and binary files with and without command line arguments.

Text Books:

1. Stephen G. Kochan - Programming in C,Third Edition, CBS publishers and distributors, 2001.
2. R. G. Dromey - "How to solve it by Computer", , Pearson Education, 2009.
3. Mathias Felleisen, Robert Bruce Findler, Matthew Flatt and Shriram Krishnamurthi - "How to Design Programs", Prentice Hall of India Pvt. Ltd., 2004.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie – "The C programming Language", Second Edition, Prentice−Hall, 1998 .
2. K.N.King – "C Programming – A Modern approach", W.W. Norton Company, London, 2008.
3. NPTEL Link – http://www.youtube.com/watch?v=3QiItmIWmOM

Learning Outcomes:

Unit – I	The learner will gain knowledge about the methods of problem solving, algorithm writing and the basic elements of C language such as the data types, variables, various control structures, statements and expressions.
Unit – II	The leaner will be exposed to the concepts of functions and arrays with their usages, syntaxes, types and the various restrictions. They will also learn to write simple programs incorporating those concepts to solve problems.
Unit – III	The learner will learn and understand the usage of structures, strings and points. They will learn to apply those concepts into different applications.
Unit – IV	The learner will learn the concepts behind file management involving creation and the manipulations of files with the help of different file handling functions in C. Besides, they will also learn the miscellaneous C concepts like unions, debugging and command line arguments.

COURSE CODE : BECDEC304 R01
COURSE NAME : PROGRAMMING IN 'C' LAB
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To learn the programming concepts of 'C' language with various application programs.

List of Experiments

1. Programs using Input, output and assignment statements
2. Programs using Branching statements
3. Programs using Looping statements
4. Programs using Functions
5. Programs using Arrays
6. Programs using Structures
7. Programs using strings
8. Programs using Pointers (both data pointers and function pointers)
9. Programs using dynamic memory allocation
10. Programs using Recursion
11. Programs using Files
12. Dividing a large program into multiple files

Learning Outcomes:

Expt. No	Outcome
1.	Learners begin to learn how to write simple programs in C by using input and assignment statements.
2.	The learners will understand how to deal with conditional statements and branching.
3.	The learners will learn to write programs that require some portion of the programs to be executed multiple times. They achieve this by using loop statements.
4.	Learners exposed to the idea of divide-and-conquer and its benefits. They begin to conceive and practice programs to consist of many functions.
5.	The learners will be able combine a group common variables under a single name. The concept of arrays is experimented through sample problems.
6.	The learners will get knowledge about the declaration, definition and usage of structures and the manipulation of structure members.
7.	The learners will be able to handle strings in their programs by using character arrays. They start using the string manipulation functions present in the library.
8.	The learners will be able get an idea about memory address, variables and pointers. They will able write programs utilizing the concepts of pointers.
9.	Learners will be able to enhance their knowledge about pointers by using them for dynamic memory allocation. They learn to use malloc and free for the creation and release of dynamic memory.
10.	The learners will understand how to invoke a function from itself by writing recursive calls.
11.	The learners will be able to work with files for the creation, opening, deletion, writing and modification of file contents.
12.	The learners will gain knowledge to work with multi-file programs through which they may divide a larger program into a number of smaller files.

Scheme of Study and Syllabi for IV Semester of
B.Tech. Electronics & Communication Engineering Programme
(Common with)
M.Tech. Communication Systems (5 -Year Integrated) Programme

S E M E S T E R – IV

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA 401R02/ MCSCMA 401R01	Engineering Mathematics - IV	3	1	-	4	4
02.	BECCEC 402 R02/ MCSCEC 402R01	Network Theory	3	1	-	4	4
03.	BECCEC 403R02/ MCSCEC 403R01	Linear Integrated Circuits	4	-	-	4	4
04.	BECCEC 404R02/ MCSCEC 404R01	Engineering Electromagnetics	4	-	-	4	4
05.	BECCEC 405R02/ MCSCEC 405R01	Analog Modulation and Systems	4	-	-	4	4
06.		Department Elective II	3	-	-	3	3
07.	BECCEC 406R02/ MCSCEC 406R01	Circuits and System Simulation Laboratory	0	-	3	3	2
08.	BECCEC 407 R01/ MCSCEC 407	Linear Integrated Circuits Laboratory	0	-	3	3	2
		Total	21	2	6	29	27

List of Departmental Electives for IV Semester

BECDEC 401R01 / MCSDEC 401R01 – Pulse and Wave Shaping Circuits
BECDEC 404 / MCSDEC 404 – Electrical Engineering
BECDEC 405 / MCSDEC 405 – Java Programming

Additional courses specified for lateral entry students

		L	T	P	C
BECDEC407R02 Programming in 'C++'	-	3	1	0	4
BECDEC408R01 Programming in 'C++' Lab	-	0	0	3	2

COURSE CODE : BECCMA401 R02 / MCSCMA401R01
COURSE NAME : ENGINEERING MATHEMATICS - IV
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objectives:

To help the learner in understanding application of Fourier series to solve wave and heat conduction problems arising in Engineering studies and to deal with higher order Partial differential equations in various branches of Engineering.

UNIT – I: Fourier Series: 15 PERIODS

Introduction – Dirichlet's Conditions – Euler's Formula – General Fourier Series – Odd and Even Functions – Half Range Series – Parseval's Identity – Complex Form of Fourier Series – Root – Mean Square (RMS) Value of a Function – Numerical Methods of Finding Fourier Coefficients - Harmonic Analysis.

UNIT – II: Partial Differential Equations (PDEs): 15 PERIODS

Formation of PDEs – Elimination of Arbitrary Constants and Functions – Complete Solution – Singular Solution – General Solution – Solution of PDE by Direct Integration – First Order Non Linear PDEs – Standard Types: $f(p,q) = 0$; $f(z,p,q) = 0$; $f(x,y,p,q) = 0$ and Clairaut's Equations – Equations Reducible to Standard Types – Lagrange's Linear Equations – Solution of Higher Order Homogeneous PDEs with Constant Coefficients.

UNIT – III: One dimensional wave and heat equations: 15 PERIODS

One Dimensional Wave Equation–Assumptions- Boundary and Initial Value Problems – Fourier Series Solution - One Dimensional Heat Equation –Assumptions- Steady and Unsteady States - Boundary and Initial Value Problems–Fourier Series Solution.

UNIT – IV: Two dimensional heat flow equations: 15 PERIODS

Two Dimensional Heat Flow Equation –Assumptions- Steady State Heat Flow in Two Dimensions – Laplace Equation in Cartesian and Polar Coordinates (including Annulus) – Fourier Series Solution.

Text Book:

1. Dr.P.Kandasamy et al -"Engineering Mathematics Vol – III" , S.Chand & Co., 2009.

Suggested Readings:

1. Erwin Kreyszig -" Advanced Engineering Mathematics" , Eighth edition, Wiley Eastern Company, 2009.
2. Dr.B.S.Grewal -"Higher Engineering Mathematics", Khanna Publishers, 2007.

3. T. Veerarajan -" Engineering Mathematics (for semester IV)" , Tata Mc Graw Hill Publishing Ltd., 2001.

Learning Outcomes:

Unit – I	The learners will be able to use Fourier series approximation for various functions and to appreciate the use of Fourier harmonics in physical problems.
Unit – II	The learners will be able to understand various methods of solving partial differential equations that govern various physical processes.
Unit – III	The learners will be capable of solving various initial and boundary value problems that correspond to vibrations of strings and heat conduction to provide Fourier series solution.
Unit – IV	The learners will have an idea to solve two dimensional boundary and initial value problems that correspond to engineering phenomena.

COURSE CODE : BECCEC 402 R02 / MCSCEC 402R01
COURSE NAME : NETWORK THEORY
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To help the learners understand the concept of two port and four port networks, understand the working of filters, attenuators, representation of signals in different domains and also to synthesize the one port network.

UNIT – I: Characteristics of Four Terminal Networks: 13 PERIODS

Symmetrical Network: Characteristic Impedance, Propagation Constant – Types of Networks (T, π, Lattice, Bridged–T, Twin–T and Ladder Networks) – Design of T and π Network. Asymmetrical Network: Image and Iterative Impedances – Image and Iterative Transfer Constant – L, T and π Networks – Bartlett's Bisection Theorem – Equivalent Network (T and π) – Matching Networks (L and T Type) – Insertion Loss.

UNIT – II: Filters, Attenuators and Equalizers: 15 PERIODS

Filters : Principle of operation - Classification -Attenuation and Phase Constant-Cut off Frequency-Analysis of Prototype Constant K filters -m-Derived Filters- Terminating section - Composite Filters
Attenuators: Symmetrical Attenuators-T, Π, Bridged-T and Lattice Attenuators-Asymmetrical Attenuators-L and T Type Attenuators – Minimum Loss Attenuator-Balanced and Unbalanced Attenuators–Ladder Attenuators-Variable Attenuator
Equalizers: Classification of Equalizers – Series and Shunt Equalizers – Inverse Network – Constant Resistance Equalizers: Full Series, Full Shunt, Bridged–T and Lattice.

UNIT – III: Analog Filter Approximation and Frequency Transformation: 15 PERIODS

Ideal Low Pass Filter- Butterworth Response –Butterworth Pole Locations-Low Pass Filter Specifications- Chebyshev Polynomial- Chebyshev Magnitude Response-Location of Chebyshev Poles -Delay Filter- Bessel-Thomson Response –Bessel Polynomial.
Frequency Transformation: Low Pass to High Pass-Low Pass to Band Pass-Low Pass to Band Stop.

UNIT – IV: Synthesis of One Port Networks: 17 PERIODS

Causality and Stabilty- Hurwitz Polynomial- Routh's Criterion-Positive Real Functions - Elementary Synthesis Procedures - Synthesis of One Port Networks with Two Kinds of Elements - LC Immittance Function - Properties of LC Immittance Function-Synthesis of LC Driving Point Immittance Functions-Foster forms and Cauer forms - RC Impedance Function -Properties- Synthesis of RC Impedances - RL Impedance Function –Properties- Synthesis of RL Impedances - RLC Impedance Function -Properties- Synthesis of RLC Impedances.

Text Books:

1. Rolf Schaumann and M.E. Van Valkenburg – "Design of Analog Filter", Oxford University Press, 2006.

2. Umesh Sinha – "Transmission Lines and Networks", Sathya Prakasham, New Delhi, 2005.
3. Gopal G.Bhise Prem R.Chadha Durgesh C.Kulshreshtha – "Engineering Network Analysis and Filter Design", Umesh publications, 2002.

Suggested Readings:

1. Sudhakar and S.P. Shyam Mohan – "Network Analysis and Synthesis", TMH 2005.
2. Umesh Sinha – "Network Analysis and Synthesis",Satya Prakasham, New Delhi,2002.
3. NPTEL Link – http://www.youtube.com/watch?v=SNjcFH24UpI.

Learning Outcomes:

Unit – I	The learner will have an understanding of the concepts of symmetrical and unsymmetrical networks, different types of network and their inter conversion. The learner will also get an understanding of characteristic impedance and propagation constant.
Unit – II	The learner will have an understanding of different types of filters; their working operation. The learner will also understand the concept of attenuators and equalizers.
Unit – III	This learner will have an understanding of the concepts of different types of filters, representation of signal in different domain, approximation of a practical filter to an ideal filter.
Unit – IV	The learner will be able to analyze if the network is realizable or not using Hurwitz and different criteria's. The learner will also be able to synthesis RL, RC and RLC network.

COURSE CODE : BECCEC 403 R02 / MCSCEC 403R01
COURSE NAME : LINEAR INTEGRATED CIRCUITS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the characteristics of operational amplifiers and to design circuits using operational amplifier for various applications.

UNIT – I: OP AMP Characteristics and Applications: 15 PERIODS

Op amp-Block Diagram, Basic Differential Amplifier Configuration, DC Characteristics, AC characteristics, Frequency Compensation. OP AMP APPLICATIONS: Inverting and Non-Inverting Amplifiers, Scale Changer -Summer and Subtractor- Differentiator and Integrator - Log and Antilog Amplifiers - Multiplier and Divider- V to I and I to V Converters - Precision Rectifiers-Clipper and Clamper Circuits-Sample and Hold Circuits- Instrumentation Amplifier-AC Amplifier.

UNIT – II:Comparators, Signal Generators and Voltage Regulators: 15 PERIODS

Comparator – Schmitt Trigger – Astable Multivibrator – Monostable Multivibrator – Triangular Wave Generator
Phase Shift Oscillator - Wein Bridge-LC Oscillator
Series OP-AMP Regulator – Fixed IC Voltage Regulator – General Purpose Regulator- Switched Mode Regulator.

UNIT – III: Active Filters and Data Converters: 15 PERIODS

Active Filters:
First Order and Second Order Low Pass - High Pass-Band Pass - Band Reject and Notch Filters - Switched Capacitor (SC) - SC Integrator. FDNR

Data Converters:
Specifications of DAC and ADC--DAC(current and voltage referenced)- Weighted resistor DAC, R-2R and Inverted R-2R Ladder Network,
ADC: Direct Type- Flash Type, Counter Type, Tracking or Servo Type, Successive Approximation Type. Indirect Type- Charge Balancing, Dual Slope

UNIT – IV: Timers and PLL: 15 PERIODS

555 Timer-Block Diagram – Modes of Operation – Monostable, Astable - Applications
PLL - Basic Principles-Block Diagram-Analog and Digital Phase Detector-Voltage Controlled Oscillator- Low Pass Filter-Monolithic PLL 565- Applications of PLL.

Text Book:

1. Ramakant A.Gayakwad -"Op amps &Linear Integrated Circuits", Fourth edition, Prentice Hall of India Pvt. Ltd, 2009

Suggested Readings:

1. K.R.Botkar-"Integrated Circuits", Fifth edition Khanna Publishers, 2010.
2. Robert F Coughlin ,Frederick F.Driscoll -" Operational Amplifiers and Linear Integrated Circuits", Prentice Hall of India, 1998.
3. Roy Choudhury and Shail Jain -" Linear Integrated Circuits", Second edition, Wiley Eastern Ltd 1995.
4. NPTEL Link – http://www.youtube.com/watch?v=uHQmNWbtwHU

Learning Outcomes:

Unit – I	The learner will be able to understand the ac and dc characteristics of operational amplifier and the various applications of operational amplifier.
Unit – II	The learner will be able to design comparators, signal generators and voltage regulators
Unit – III	The learner will be able to design filters for a given frequency response and they can design analog to digital and digital to analog converters.
Unit – IV	The learner will have an understanding of the basic function of IC 555 timer and will know how the IC 555 timer can be used to realize different circuits for various applications.

COURSE CODE	**: BECCEC 404R02 / MCSCEC 404R01**
COURSE NAME	**: ENGINEERING ELECTROMAGNETICS**
LECTURE PERIODS PER WEEK	**: 04**
TOTAL PERIODS PER WEEK	**: 04**
CREDITS	**: 04**

Course Objectives:

This course provides communication engineering students with an understanding of fundamental electricity and magnetism concepts and enables them to apply these concepts in applications.

UNIT – I: Time– varying Fields and Maxwell's Equations: **15 PERIODS**

Introduction – Review of Vectors– Faraday's Laws of Electromagnetic Induction – Transformer and Motional EMFs – Equation of Continuity – Inconsistency of Ampere's Law – Displacement Current – Maxwell's Equations – Electromagnetic Boundary Conditions – Time Harmonic Fields – Maxwell's Equations in Phasor Form – Power and Poynting's Theorem.

UNIT – II: Electromagnetic Wave Propagation: **15 PERIODS**

Introduction – general Wave Equations – Wave Propagation in Lossy Dielectrics and in Lossless Dielectrics – Free Space Wave Propagation – Plane Waves in Good Conductors – Reflection of Plane Wave at Normal Incidence and at Oblique Incidence – Polarization of a Wave – Linear, Elliptical and Circular Polarization

UNIT – III: Transmission Lines: **15 PERIODS**

Introduction – Transmission Line Parameters – Transmission Line Equations – Lossless and Distortion Less Lines – Input Impedance, Standing Wave Ratio and Power – Shorted, Open and Matched Lines – Smith Chart – Quarter-Wave Transformer and Single Stub Tuner

UNIT – IV: Waveguides : **15 PERIODS**

Introduction – Rectangular Waveguides – Transverse Magnetic (TM) Modes – Transverse Electric (TE) Modes – Impossibility of TEM Wave in Wave Guides – Wave Propagation in the Guide– Power Transmission and Attenuation – Losses in a Wave Guide – Cavity Resonators.

Text Book:

1. Matthew N.O.Sadiku - "Principles of Electromagnetics" Oxford University Press, New York, Fourth edition., 2007

Suggested Readings:

1. Edward C. Jordan and Keith G. Balmain - "Electromagnetic Waves and Radiating Systems" Prentice Hall of India, New Delhi, 2006.
2. Bhag Singh Guru and Huseyin R.Hiziroglu -"Electromagnetic Field Theory Fundamentals" Vikas Publishing House, New Delhi, 2005.
3. David K.Cheng - "Field and wave Electromagnetics" Pearson Education Asia, Second edition, 2004.
4. NPTEL Link – http://freevideolectures.com/Course/2340/Electromagnetic-Fields.

Learning Outcomes:

Unit – I	Upon successful completion of this unit students will a) be able to use complex vectors in different coordinate systems. b) Understand the coupling between electric and magnetic fields through Maxwell's equations. c) Understand constitutive parameters and boundary conditions and be able to analyze the relationships between fields d) be able to interpret the energy and power associated with electromagnetic fields.
Unit – II	Upon successful completion of this unit students will a) be able to identify the wave equation b) be able to explain the propagation of electromagnetic waves in different material media. c) Understand the phenomena of reflection and transmission of waves between different media. d) Understand the meaning of polarization of waves.
Unit – III	Upon successful completion of this unit students will a) Come to know of the various types of transmission lines and the associated line parameters. b) be able to calculate the solutions of the one dimensional transmission line equations. c) Come to understand the propagation characteristics of basic T.L. Configurations and their various applications d) Come to use Smith chart and methods of impedance matching using quarter wave transformer and single stub tuner.
Unit – IV	Upon successful completion of this unit students will a) be able to develop solutions for the propagation of electromagnetic waves in rectangular waveguides under TE and TM modes. b) Understand the transmission of power and attenuation as well as associated losses. c) be able to understand the concepts of cavity resonators and the various types and applications in different areas.

COURSE CODE	**: BECCEC 405R02 / MCSCEC 405R01**
COURSE NAME	**: ANALOG MODULATION AND SYSTEMS**
LECTURE PERIODS PER WEEK	**: 04**
TOTAL PERIODS PER WEEK	**: 04**
CREDITS	**: 04**

Course Objective:

- To understand the principle and operations of various analog modulation schemes
- To learn different parameters involved in the design of transmitters and receivers
- To learn various types of noise which can influence the communication systems as a whole.

UNIT – I: Linear Modulation: 15 PERIODS

Hilbert transform – definition, interpretation as a phase selective filter, properties of Hilbert transform. Application of Hilbert transform – analytic signal and complex envelope representation of bandpass signals. Bandpass systems
Baseband signals, Theory of AM, Normal AM (DSBFC),, Amplitude modulation index, AM Spectrum, average power of Sinusoidal AM, Double sideband Modulation (DSB-SC), Single sideband modulation and coherent detection. Modulation by several sine waves. Resulting modulation index. Advantage and disadvantage of Amplitude Modulation (AM). Practical details of AM transmission.Vestigial sideband and its applications to TV transmission. Generation and detection of AM, DSBSC and SSB. Envelope detection as a simple detector (as opposed to coherent demodulation in DSB-SC)..
Introduction to QAM and Independent sideband amplitude modulation. Comparison and application of various AM systems. Costas Loop.

UNIT – II: Angle (Frequency and Phase) Modulation: 18 PERIODS

Angle modulation – Instantaneous frequency, Concept of angle modulation, Phase and frequency modulation – Mathematical representation of FM and PM. Sinusoidal FM-Narrowband and wideband, their spectrum, Bessel function. Carson's rule. Modulation index- Deviation sensitivity, Frequency deviation, percentage modulation, Bandwidth requirement for Angle modulated wave. Deviation ratio for non-sinusoidal FM. Average power in sinusoidal FM. Phase Modulation- Sinusoidal phase modulation, Digital phase modulation.
Generation and detection of FM and PM using Phase locked loop (PLL.). Quadrature detector and zero crossing detector.. Comparison of FM and PM.

UNIT – III: Transmitters and Receivers: 15 PERIODS

AM transmitter, SSB transmitter.AM receivers- Superhetrodyne receivers.SSB receiver with pilot carrier. Communication receiver. Receiver parameters. Automatic gain Control(AGC) - Squelch circuit.

FM transmitter – Crosby Direct transmitter, Armstrong indirect method transmitter, FM stereo broadcasting, FM in TV broadcasting.
FM receivers – Limiter-Discriminator receiver, FM stereo receiver.

UNIT – IV: Noise: **12 PERIODS**

Introduction. Various types of noise – Signal to Noise ratio- Noise figure – Noise temperature – SNR and CNR. Measurement of Noise temperature and Noise factor. Noise in band pass system. Noise in AM, DSB, SSB systems. Effect of noise on Angle modulation.. Pre-emphasis and de-emphasis circuit. Threshold effect in angle modulation.
FMFB technique- threshold extension circuit.

Text Books:

1. V.Chandra Sekar- "Analog Communication"- Oxford University Press, Third impression, 2012.
2. Ziemer and Tranter - "Principles of Communications – Systems, modulation and Noise", Sixth edition, John Wiley & Sons,2010.
3. Carlson, Crilly and Rutledge - "Communications Systems" , Fifth edition, Mc-Graw Hill Education, 2009.
4. Simon HAYKIN- "Communication Systems", Fourth edition , Wiley India, 2009.
5. John G.Prokais & Masoud Saleh – "Communication Systems", Fourth edition, Pearson education, 2006.

Suggested Reading:

1. B. P. Lathi and Zhi Ding - "Modern Digital and Analog Communication Systems ".- Oxford university Press, 2010.
2. NPTEL Link – http://nptel.ac.in/video.php?subjectId=117102059.

Learning Outcomes:

Unit – I	The learner will have an understanding of the concept of generation and detection of various amplitude modulation systems
Unit – II	The learner will have an understanding about the concept of angle modulation
Unit – III	The learner will be able to understand the principles of AM &FM transmitters
Unit – IV	The learner will have an understanding about the principle of various types of noises and noise performances in AM & FM

COURSE CODE : BECDEC 401R01 / MCSDEC 401R01
COURSE NAME : PULSE AND WAVE SHAPING CIRCUITS
LECTURE PERIODS PER WEEK : 03
TOTAL PERIODS PER WEEK : 03
CREDITS : 03

Course Objective:

- To learn the design aspects of various pulse shaping circuits.
- To understand the intricacies of switching characteristics of various active devices.

UNIT – I: Linear wave shaping and non-linear wave shaping : 12 PERIODS

Linear wave shaping: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator, RL and RLC Circuits and their response for Step Input, Ringing Circuit.
Non Linear wave shaping: Diode clippers, Transistor clippers, Clipping at two independent levels, Comparators, Applications of Voltage comparators. Clamping Operation, Clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem, Practical Clamping Circuits, Effect of Diode Characteristics on Clamping Voltage, Synchronized Clamping.

UNIT – II: Switching characteristics of devices: 11 PERIODS

Switching characteristics of devices: Diode as a Switch, Piecewise Linear Diode Characteristics, Diode Switching times, Transistor as a Switch, Break down voltages, Transistor in Saturation, Temperature variation of Saturation Parameters, Transistor-switching times.

UNIT – III: Multivibrators: 11 PERIODS

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors.

UNIT – IV: Time base generators and Sampling gates: 11 PERIODS

Time base generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, Miller and Bootstrap Time base Generators-Basic Principles, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, Transistor Current Time Base Generators, Methods of Linearity improvement.
Sampling gates: Basic operating principles of Sampling Gates, Unidirectional and Bi-directional Sampling Gates, Four Diode Sampling Gate, Reduction of pedestal in Gate Circuits, Six Diode Gate, Application of Sampling Gates.

Textbooks:

1. J. Millman, H. Taub and Mothiki S. Prakash Rao - "Pulse, Digital and Switching Waveforms", second edition, TMH, 2008.
2. David A. Bell - "Solid State Pulse circuits", fourth edition, PHI, 2002.

Suggested readings:

1. A. Anand Kumar - "Pulse and Digital Circuits",PHI, 2005.
2. R.Venkataraman - "Pulse, Digital Circuits and Computer Fundamentals", Dhanpat Rai & Sons, 1990.
3. NPTEL Link – http://freevideolectures.com/Course/2261/Basic-Electronics-and-Lab/8

Learning Outcomes:

Unit – I	The learners will be able to understand the intricacies of wave shaping with the help of linear and non-linear wave shaping circuit elements.
Unit – II	The learners will have an understanding of the switching characteristics of various active devices with an emphasis on various switching issues.
Unit – III	The learners will be able to analyze and design the various multivibrator circuits for pulse shaping applications.
Unit – IV	The learners will be able to understand the significance of time base generators and sampling gates for pulse and wave shaping applications.

COURSE CODE : BECDEC 404 / MCSDEC 404
COURSE NAME : ELECTRICAL ENGINEERING
LECTURE PERIODS PER WEEK : 03
TOTAL PERIODS PER WEEK : 03
CREDITS : 03

Course Objective:

To understand the basic principles and operations of DC machines, transformers, alternators and induction motors.

UNIT – I :DC Machines: 11 PERIODS

DC Machines –Constructional Details –Types-Principle of Operation-Method of Excitation, Separately Excited and Self Excited Generators – EMF equation-OCC and Load Characteristics-Applications.
DC Motors-Concept of Back EMF and Energy Conversion-Torque Developed-Performance Characteristics – Applications.

UNIT – II :Transformers and Alternators: 12 PERIODS

Single Phase Transformer-Constructional Details-Principle of Operation-EMF Equation –Phasor Diagram Under No-Load and Load condition-Applications
Alternators-Constructional Details-Types-Principle of Operation-EMF Equation Applications.
Synchronous Motor-Principle of Operation-Methods of Starting-Applications.

UNIT – III :Three Phase and Single Phase Induction Motors: 11 PERIODS

Three Phase Induction Motor-Constructional Details-Types-Principle of Operation-Torque Equation-Torque Slip Characteristics-Applications.
Single Phase Induction Motor-Principle of Operation-Split Phase, Capacitor Start and Capacitor Run Types-Applications.

UNIT – IV : Electrical Measurements and Illumination: 11 PERIODS

Construction and Principle of Operation of PMMC and MI Ammeter and Voltmeter-Dynamometer Wattmeter-Single Phase Induction Type Energy Meter-Megger.
Illumination-Definition of Key Words-Sources of Light – MHCP and MSCP-Laws of Illumination and Calculations with Simple Problems – Incandescent, Fluorescent, Mercury Vapour and Sodium Vapour Lamps.

Text books:

1. B.L. Theraja -" Fundamentals of Electrical Engineering and Electronics,S.Chand & Co,2006.
2. B.L. Theraja -" Electrical Technology", Volume II, S. Chand & Co., 1998.

Suggested Readings:

1. A.K. Sawheny - "A course in Electrical & Electronic Measurement and Instrumentation", Dhanpat Rai & Sons, 2000.
2. I.J. Nagrath & D.P. Kothar i-" Electrical Machines", Tata McGraw-Hill Publictions, 1999.
3. S.L. Uppal - "Electrical Power", Khanna Publishers, 1997.
4. NPTEL Link – http://www.youtube.com/watch?v=qmcriUdYBW0

Learning Outcomes:

Unit – I	Learners will have an understanding of operating characteristics of the DC machines and motors
Unit – II	Students will have an understanding of the principle and operations of Transformers and Alternators
Unit – III	Learners will have an understanding of the principle and operation of DC motors and 3-Ø induction motors
Unit – IV	Students will have an understanding of the Electrical Measurement devices and laws of Illumination

COURSE CODE : BECDEC 405 / MCSDEC 405
COURSE NAME : JAVA PROGRAMMING
LECTURE PERIODS PER WEEK : 03
TOTAL PERIODS PER WEEK : 03
CREDITS : 03

Course Objective:

- To understand the concepts of Java programming syntax, control structures.
- To Build Java Application and Java Applet.
- To Understand and utilize Java Graphical User Interface in the program writing.
- To Identify Java standard libraries and classes.

UNIT – I: Introduction to Object Oriented Programming: 11 PERIODS

Introduction to Object Oriented Programming - Genesis of Java - Overview of Java - Data types, Variables and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes - Overloading - Understanding Static, Final - Nested and Inner Classes - String Class - Command Line Arguments - Inheritance - I/O Basics - Packages and Interfaces - Exception Handling.

UNIT – II: Multithreading and Event Handling: 11 PERIODS

Multithreaded Programming - Java Thread Model - Creating Multiple Threads - Thread Priorities - Synchronization - Inter Thread communication - Suspending, Resuming and Stopping Threads - Applets - Fundamentals - Applet Class - Applet Skeleton - Event Handling - Event Classes – Event Listener Interfaces - Adapter Classes - Inner Classes.

UNIT – III: Abstract Windowing Tool kit and Networking: 11 PERIODS

AWT - Window Fundamentals - Working with Frame Windows, Graphics, Colors and Fonts - Using AWT Controls, Layout Managers and Menus – Control Fundamentals - Understanding Layout Managers - Java RMI - Networking - Basics - Networking Classes and Interfaces - Internet Address - TCP/IP Socket, Server Socket Classes - UDP Datagram, Socket, Datagram Packet Classes

UNIT – IV: JAVA Library: 12 PERIODS

Java Library - String handling - String Operation, Comparison, Searching, Modifying - String Buffer - Java.lang - Simple Type Wrappers – Math - Java.util - Collection Interfaces - Collection classes – Legacy classes - Stack - Dictionary - Hash table - Date Class - Random Class - java.io - File - Byte Streams - Character Streams - Serialization .

Text Books:

1. Harvey M. Deitel, Paul J. Deitel - "Java: How to Program", Seventh edition, Deitel & Associates Inc., 2006.
2. Herbert Schildt- "The Complete Reference Java 2", Fifth edition, Tata McGraw Hill Edition, 2002.

Suggested Readings:

1. NPTEL Link 1 – http://www.youtube.com/watch?v=uUhOEj4z8Fo
2. NPTEL Link 2 – http://www.youtube.com/watch?v=3uxp7mqUIfk

Learning Outcomes:

Unit – I	The learner will have an understanding about Inheritance and concepts of polymorphism. Students trained to write programs on Packages and Interfaces. They will able to analyze various exceptions and trained to write programs on exception handling.
Unit – II	The learner will have an understanding about Multithreading. Students will able to develop their own Applets with the support of event handling mechanisms.
Unit – III	The learner will have knowledge on GUI components, Graphics class. They will able to develop APIs. They will have an idea about Networking using java.
Unit – IV	The learner will have an idea about Java standard libraries and classes. The learners will able write programs on Collection Interfaces - Collection classes –Legacy classes and on java.util package. The learner will write programs on files.

COURSE CODE : BECCEC 406 R02 / MCSCEC 406R01
COURSE NAME : CIRCUITS AND SYSTEM SIMULATION LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

- To simulate and analyze the various signals and systems using Matlab and Open source Scilab platforms.
- To perform device modeling to construct electronic systems using Multisim simulation environment.

List of Experiments

System related experiments using Matlab:

1. Transformation of the Independent Variable in Signals.
2. Analyzing System Properties for unknown Systems Given the H(T).
3. Interpretation of the unit Impulse Function (Delta Function) and Determination of the Impulse Response of a System.
4. Linear Convolution Operation.
5. Approximation of Periodic Signals using Fourier Series.
6. Approximation of a Rectangular Pulse using Fourier Transform.

Learning Outcomes:

Expt.No	Outcome
1.	The learners will be able to understand the consequence of time shifting, scaling, amplitude shifting, scaling properties of signals using Matlab simulation.
2.	The learners will be able to study the system properties such as casual or non-casual, static or dynamic, stability using MATLAB code.
3.	The learners will be able to infer the impulse response, its significance and its influence in the output of a system using MATLAB code.
4.	The learners will be able to analyze the linear convolution of two signals using MATLAB code.
5.	The learners will be able to study the Gibbs phenomenon by Fourier series approximation using MATLAB code.
6.	The learners will be able to study the Fourier Transform of the rectangular pulse resulting in sinc function using MATLAB code.

System related experiments using Scilab Open source :

1. Waveform Generation – Impulse, step, Sine, cosine, Ramp , triangualar etc.,.
2. Sampling Explorer: Demonstration of How Continuous Signals are Sampled, Quantized and Reconstructed.
3. Waveform Explorer: Demonstration of how any Periodic Waveform Can be Created by Adding Together Sinusoids.
4. Circular Convolution operation
5. Finite State Machine modeling

Learning Outcomes:

Expt.No	Outcome
1.	The learners will able to assemble the Scilab code for the generation of basic waveforms like sine, cosine, Ramp signal, Exponential signal etc
2.	The learners will be able to understand the intricacies of sampling, need for sampling, its types, quantization and reconstruction of the sampled data using the simulation of Scilab code.
3.	The learners will be able to understand the addition of periodic waveforms and the further signal manipulations using Scilab code simulation.
4.	The learners will be able to simulate the Scilab code for circular convolution of two signals.
5.	The learners will be able to model the various finite state machines using Scilab code.

Experiments Using Circuit Simulation Software:

1. Diode Characteristics
2. Transistor Characteristics
3. Amplifiers
4. Oscillators
5. Active Filters
6. Multivibrators
7. A/D and D/A Converters

Learning Outcomes:

Expt.No	Outcome
1.	The learners will be able to understand and analyze the V-I characteristics of pn junction diode and zener diode under various operating conditions.
2.	The learners will be able to simulate the input and output characteristics of common base and common emitter transistor and compare the performance of both.
3.	The learners will be able to design and simulate the working of RC coupled amplifier and single tuned amplifier. They will also be able to analyse the Gain - bandwidth issues of the amplifiers and tuning frequency.
4.	The learners will be able to design and simulate the Hartley and colpitt oscillators. They will also gain knowledge about the difference between RC and LC oscillators.
5.	The learners will be able to design and simulate the first order and second order filters namely Butterworth and chebyschev filters.
6.	The learners will be able to design and simulate various multivibrators like astable, bistable and monostable multivibrator.
7.	The learners will be able to simulate analog to digital converter and vice versa.

COURSE CODE : BECCEC 407R01 / MCSCEC 407
COURSE NAME : LINEAR INTEGRATED CIRCUITS LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course objective:

To reinforce the theoretical knowledge gained for practical design and implementation of circuit for various signal conditioning applications.

List of Experiments

1. Inverting and non- inverting and differential amplifier using op-amp
2. Applications of op-amp: Summer, Subtractor, integrator and differentiator
3. Inverting and non-inverting Zero crossing detector and Schmitt trigger using op-amp
4. Precision half wave and full wave rectifier and clippers using op-amp
5. Wein bridge oscillator and RC phase shift oscillator using op-amp
6. Astable and Monostable multivibrator using op-amp
7. Triangular wave generation using
   (i) minimum number of components
   (ii) astable multivibrator and integrator
8. Second order low pass and high pass filter and notch filter for the given cutoff frequency using op-amp
9. Astable and Monostable multivibrator using IC 555 timer
10. Design of PLL using discrete components
11. Construction of D/A and A/D converter using op-amp (using standard 8-bit IC)
12. Voltage regulator using IC723 (load and line regulation)

Learning outcomes:

Expt. No.	Outcomes
1.	The learners will be able to design inverting, non inverting and differential amplifier circuits using op-amp for any gain value.
2.	The learners will be able to design some of the applications of op-amp namely summer, subtractor and differentiator.
3.	The learners will be able to design inverting and non-inverting zero crossing detector. They will be able to design schmitt trigger using op-amp for any given threshold value
4.	The learners will be able to construct a rectifier to rectify below the cut in voltage of the diode and clippers to clip at any level using op-amp. .
5.	The learners will be able to design an audio oscillator for a given cut off frequency.
6.	The learners will be able to design multivibrator circuits using op-amp for a given frequency.
7.	The learners will be able to design triangular wave generator using astable and comparator for any given frequency.
8.	The learners will be able to design second order filters namely low pass and high pass for a given cut off frequency. They will be able to design notch filter for a particular notch frequency.
9.	The learners will be able to design multivibrator circuits using IC 555 for a given frequency..
10.	The learners will be able to design Phase Locked Loop(PLL) using discrete components.
11.	The learners will be able to implement Digital to Analog and Analog to Digital converters using standard ICs..
12.	The learners will be able to design voltage regulators using IC 723 for low voltage and high voltage and also calculate the percentage error in regulation.

COURSE CODE : BECDEC407 R02
COURSE NAME : PROGRAMMING IN 'C++'
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To assist the learners to solve any type of problems by mapping with real world environment.

UNIT – I: 15 PERIODS

Introduction: Fundamentals of object oriented programming – procedure oriented programming Vs. object oriented programming (OOP), Object oriented programming concepts – Classes, reusability, encapsulation, inheritance, polymorphism, dynamic binding, message passing. C++ Programming Basics: Output Using cout, directives, input with cin, type bool, setw Manipulator,type Conversions.
Functions: returning values from functions, reference arguments, overloaded function, inline function, default arguments, returning by reference.

UNIT – II: 15 PERIODS

Object And Classes: Implementation of Class in C++, C++ Objects Vs Physical Object, C++ Object As Data Types, Constructor, Object As Function Arguments, the Default Copy Constructor, returning Object From Function, Structures And Classes, Classes Objects And Memory Static Class Data, Const Data and Classes.
Arrays and String Arrays Fundamentals: Arrays as Class Member Data, Arrays Of Object, String, the standard C++ String Class.
Operator Overloading: Overloading Unary Operators,
Overloading of Binary Operators, Data Conversion, Pitfalls of Operators Overloading and Conversion, Keywords Explicit and Mutable.

UNIT – III: 15 PERIODS

Inheritance: Concept of Inheritance, Derived Class And Base Class, Derived Class constructors, Overriding Member Function, Inheritance In The English Distance Class, Class Hierarchies, Inheritance And Graphics Shapes, Public And Private Inheritance, Levels Of Inheritance, Multiple Inheritance, Ambiguity In Multiply Inheritance, Aggregation: Classes Within Classes, Inheritance and program Development.
Pointers: Addresses and pointer, The Address-Of Operator &, Pointer and Arrays, Pointer and Fraction, Pointer And C- Types String.
Memory Management: New And Delete, Pointers to Objects, Debugging pointers.
Virtual Function: Virtual Function, Friend Function, Static Function, Assignment And Copy Initialization, This Pointer, Dynamic Type Information.

UNIT – IV: 15 PERIODS

Streams and Files: Streams Classes, Stream Errors. Disk File I/O with Streams, File Pointers, Error Handling in File I/O, File I/O With Member Function, Overloading the Extraction And Insertion Operators, Memory As A Stream Object, Command line Arguments, and Printer Out put.
Templates and Exceptions: Function Templates, Class Templates Exceptions.
Multi file Programming: Reasons for multi-file programming, creating multi-file program, A very long number class, A high rise elevator simulation

Text Book:

1. Robert Lafore, Object oriented programming in C++ (Third Edition), Galgotia publishers private Limited, New Delhi, 2009.

Reference Books:

1. KR Venugopal,Rajkumar and T Ravishankar – "Mastering C++", Tata McGraw Hill Publishing Co.Ltd., New Delhi, 1997.
2. Jense Liberty, Tim Keogh – "C++: An introduction to programming" BPB Publications, New Delhi, 2001.
3. Stephen Parata – "C++ Primer", TMH Publishing Co. Ltd., New Delhi, 2000.

Learning Outcomes:

Unit – I	The learner will get knowledge with basics of object oriented concepts.
Unit – II	The learner will get exposed to core concepts like classes and objects.
Unit – III	The learner will understand the purpose of inheritance and pointers.
Unit – IV	The learner will get knowledge about file and streams with exception handling.

COURSE CODE : BECDEC408R01
COURSE NAME : PROGRAMMING IN 'C++' LAB
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To help the learners to understand oops concepts and they are able to write programs for any complex problems.

List of Experiments

1. Programs using Branching
2. Programs using Multi Dimensional Array
3. Programs using Function Overloading and Inline Functions
4. Programs using Classes and Objects (Array as Data Member and Array of Objects)
5. Programs using Constructors and Destructor
6. Programs using 'String' class
7. Programs using Operator Overloading
8. Programs for Data Conversion using Overloading
9. Programs using Inheritance
10. Programs using Virtual Functions and Friend Functions
11. Programs using Templates
12. Programs using Files
13. Dividing Large Program into Multiple Files

Learning Outcomes:

Expt.No	Outcome
1.	Learners get to know about the usages of branching statements by implementing sample programs.
2.	The learners will able to work with multidimensional arrays with various applications.
3.	The learners will get exposed to function overloading by differing number and types of parameters. They also learn to make program work faster by using inline functions.
4.	Learners experiment with classes and objects through simple applications.
5.	The learners will be able to do various programs using constructors and destructors.
6.	The learners will get knowledge about how to work with string data types and manipulations of strings.
7.	The learners will get exposed to core concepts of oops like operator overloading.
8.	The learners will be able to convert one class type to another i.e. user defined to basic and vice-versa.
9.	The learners will get exposure in inheritance with its application.
10.	The learners will get knowledge about the usage of virtual function and friend function.
11.	The learners will be able to work with templates.
12.	The learners will get knowledge to work with file system.
13.	The learners will get know to with larger programs using multifile system.

Scheme of Study and Syllabi for V semester of
B.Tech. Electronics & Communication Engineering Programme
(Common with)
M.Tech. Communication Systems (5 -Year Integrated) Programme

S E M E S T E R – V

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCMA501 R01 / MCSCMA501 R01	Engineering Mathematics – V (Probability and Random Processes)	3	1	-	4	4
02.	BECCEC502 R02 / MCSCEC502 R02	Microprocessors	4	-	-	4	4
03.	BECCEC503 R01 / MCSCEC503 R01	Antenna and Wave Propagation	4	-	-	4	4
04.	BECCEC504 R01 / MCSCEC504 R01	Digital Communication	4	-	-	4	4
05.		Department Elective III	4	-	-	4	4
06.		Department Elective IV	4	-	-	4	4
07.	BECCEC505 R02 / MCSCEC505 R02 /	Microprocessors Laboratory	0	-	3	3	2
08.	BECCEC506 R01 / MCSCEC506 R01	Communication Laboratory	0	-	3	3	2
09.	BECCTP507 R02 / MCSCTP507 R01	HR Skills-I	2	-	-	2	2
		Total	**25**	**1**	**6**	**32**	**30**

List of Departmental Electives for V Semester

BECDEC501 R01 / MCSDEC501 R01 - Optical Communication
BECDEC505 R01 / MCSDEC505 R01 - Biomedical Instrumentation
BECDEC506 / MCSDEC506 - Virtual Instrumentation
BECDEC507 / MCSDEC507 - Television Engineering
BECDEC 508/MCSDEC508 - Power Electronics

COURSE CODE : BECCMA501R01 / MCSCMA501R01
COURSE NAME : ENGINEERING MATHEMATICS – V
(Probability and Random Processes)
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIODS PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the key concepts in Probability, Statistical Distributions correlation and Regression analysis and Random processes so as to understand Engineering subjects such as Statistical Theory of Communication, Machine Learning Techniques etc.

UNIT – I : Probability and Distributions: **15 PERIODS**

Basic concept of probability – Conditional probability and Baye's Theorem – Concept of a Random variable – Transformation of random variables – Cumulative Distribution Function (CDF) – Probability Density Function – Basic Statistical Properties of a Random variable and Expected Values – Moments – Binomial , Poisson , Normal , Erlang and Cauchy Distributions – Moment Generating Functions – Addition Theorem – Recurrence relations.

UNIT – II: Correlation, Regression and Tests of Hypothesis: **15 PERIODS**

Linear correlation – Rank correlation – Regression analysis – Problems
Introduction to inferential statistics – Procedure for Testing of Hypothesis – Tests of significance for large samples – Difference between sample proportion and population proportion – Difference between two sample proportions – Test of significance for small samples – Student's t-distribution – Difference between sample mean and population – Difference between two sample means – F distribution – Chi Square distribution – Goodness of fit – Independence of Attributes.

UNIT – III : Random Processes: **15 PERIODS**

Classification of random processes – Methods of description of a random process – Special classes of random processes – Multiplicative random process - Average values of random processes – Stationarity – Examples of wide sense stationary process and strict sense stationary process – Analytical representation of a random process – Ergodic process – Autocorrelation function and its properties – Cross correlation function and its properties – Weiner Khinchin's Theorem – Power Spectral density – Random process in Linear Time Invariant (LTI) system.

UNIT – IV : Special Classes of Random Processes: **15 PERIODS**

Introduction – Bernoulli Random Process – Poisson Process – Birth and Death Process – Difference Equations – Pure Birth process – Yule – Furry Process – Renewal Process – Discrete state – Discrete Time renewal process – Discrete state continuous parameter Renewal Process – Solution to Renewal equations.

Text Books:

1. T.Veerarajan – "Probability ,Statistics and Random Processes " , 2nd Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi 2003. [for UNITs II , III and IV]
2. Jorge I. Aunon and V. Chandrasekar – "Introduction to Probability and Random Processes", 3rd Edition , McGraw Hill International Editions, New York, 1998.[for UNITs I and III]

Suggested Readings:

1. S.C.Gupta , V.K.Kapoor – " Fundamentals of Mathematical Statistics", 10th revised Edition, Sultan Chand and Sons Publications, 2007.
2. George R. Cooper, Clare D. McGillem - "Probabilistic Methods of Signal & System Analysis", 3rd Edition, Oxford Press, 2007.
3. Peebles, P.Z. – "Probability, Random Variables and Random Signal Principles", 4th Edition, McGraw Hill, New York, 2005.
4. Papoulis, A. – "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw Hill, New York, 2005.
5. NPTEL Link – http://www.youtube.com/watch?v=r1sLCDA-kNY.

Learning Outcomes:

Unit – I	The learner will have an understanding of the fundamental concepts of basic Probability Theory, Statistical Distributions to apply in problem situations.
Unit – II	The learner will have an understanding of Correlation and Regression Analysis before entering into Probabilistic Network Architectures.
Unit – III	The learner will be able to analyze different techniques involved in Random processes and apply in real time problem situations.
Unit – IV	The learner will be having ability to comprehend special type of Random processes so as to cater the needs of Statistical Learning Theory based projects to be taken up by them in higher semesters to prepare software codes.

COURSE CODE : BECCEC502R02 / MCSCEC502R02
COURSE NAME : MICROPROCESSORS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the basic architecture of general purpose microprocessors, to gain extensive knowledge on 8086, 80386 and ATOM processors, to interface various devices with processors for wide range of applications.

UNIT – I : Introduction to 8086 and Assembly Programming: 15 PERIODS

Basic Components of Microprocessor – Types of Architecture: Von-Neumann – Harvard – CISC – RISC – Microcomputer - Structured Computer Organization.
Intel 8086 architecture – Registers – Memory segmentation – Pin description – Minimum and maximum mode – Read and write bus cycles – Interrupt processing.
Machine language Vs Assembly language – Assembler – Cross assembler – Assembler directives. Assembly programming with 8086: Addressing modes – Instruction set – Assembly programs on ALU operations, I/O memory accessing and Interrupts.

UNIT – II : Intel 80386 Architecture: 15 PERIODS

Architecture of 80386 – Registers – Pin Functions – Memory management: Segmentation – Global, Local and Interrupt Descriptors. Paging: Page directory – Page table – Operating modes: Protected mode – Real mode – Virtual mode.

UNIT – III : Programming 80386 and Peripheral ICs: 15 PERIODS

Assembly programming with 80386: Addressing modes – Instruction set – Assembly programs on ALU operations, GPIO accessing and Peripheral programming.
Peripheral ICs: 8255 PPI – 8253 PIT – 8259 PIC – 8237 DMA – 8251 USART.

UNIT – IV: Introduction to ATOM Processor and Interfacing Applications: 15 PERIODS
Introduction to ATOM Processor: Features – Block diagram – Overview of Intel Atom Processor components – Programming on ALU operations – GPIOs.
Interfacing Applications: Implementation of Counter – Keypad interface – Stepper Motor interface – DAC interface.

Text Books:

1. Soumitra Kumar Mandal – "Microprocessors and Microcontrollers: Architecture, Programming and Interfacing using 8085, 8086 and 8051", Tata McGraw Hill, 2011.
2. Nilesh B Bahadure – "Microprocessors and the Pentium Family", PHI, 2010.
3. Barry B. Brey – "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, PentiumPro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", 8th Edition, Pearson, Prentice Hall, 2009.

Suggested Readings:

1. D. A. Patterson and J. L. Hennessy – "Computer Organization and Design", 4th Edition, Elsevier Inc., 2012.
2. Intel Atom Processor E6xx Series: Datasheet - January 2011.
3. AK Ray, K M Bhurchandi – "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing", Tata McGraw-Hill, 2nd Edition, 2006.
4. Douglas V. Hall – "Microprocessors and Interfacing" – 2nd Edition, Tata McGraw Hill, 2005.
5. NPTEL Link – http://www.youtube.com/watch?v=liRPtvj7bFU.

Learning Outcomes:

Unit – I	The learners will be able to understand the various processor architectures, bus and memory organizations and the usage of interrupts. They will be able command 8086 processor to perform various applications through assembly language programs
Unit – II	The learners will have an understanding of the basic architecture of 80386 microprocessor along with memory segmentation and various operating modes involved.
Unit – III	The learners will be able to understand the various addressing modes available in 80386 and to code assembly language programs. They will be able to access and understand various GPIO's and peripheral devices.
Unit – IV	The learners will have an understanding of the ATOM processor. They will be able to interface ATOM processor with other devices.

COURSE CODE : BECCEC503R01 / MCSCEC503R01
COURSE NAME : ANTENNA AND WAVE PROPAGATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the principle, construction and radiation pattern of various types of antennae.
- To understand the concepts of radio wave propagation and measurements.

UNIT – I: Radiation elements and antenna fundamentals: 15 PERIODS

Definition of antenna – antenna as oscillating dipole –Retarded fields – Retarded potentials – Radiation from a short dipole – Power radiation by point source – Radiation resistance – Radiation patterns – Reciprocity theorem and Friis formula – Directivity – Gain and aperture concept.

UNIT – II: Wire, loop and array antennas: 15 PERIODS

Effect of ground on antenna – antenna feeds - Thin linear antenna – Field of a thin linear antenna with uniform travelling wave – V and Rhombic antennas - Loop antenna – Fields and its applications – Adcock antenna – Antenna arrays - Definition – array of two point sources – radiation patterns – Linear array of n elements – Pattern multiplication– Phasor addition – Linear arrays of non-uniform amplitude distribution – Binomial and phased arrays – electronically steered array – collinear and stacked arrays-Optimum antenna arrays-Signal processing arrays.

UNIT – III: Practical antennas: 15 PERIODS

Yagi uda antenna – Helical antenna – Reflector antenna – Horn, lens and slot antennas – Patch antenna- antenna for low, medium and high frequencies – frequency independent antennas– Covington antenna(qualitative study only).

UNIT – IV: Radiowave Propagation and Measurement: 15 PERIODS

Types of radiowave propagation- atmospheric effects on radio propagation on Sea and Land – radio refractive index – duct propagation –Line of sight propagation– ionospheric effects on radiowaves – critical frequency, skip distance and maximum usable frequency – fading of signals –diversity reception- measurement of antenna impedance and radiation pattern – ionospheric measurements.

Text Books:

1. Edward C. Jordan and K.G.Balmain – "Electromagnetic waves and radiating systems", 2nd Edition, PHI, 2009.
2. John D.Kraus - "Antennas for all applications", 3rd Edition, Tata Mcgraw-Hill , 2008.

Suggested Readings :

1. Constantine A.Balanis - "Antenna Theory : Analysis and design", 3rd Edition, Wiley India Pvt. Ltd., 2009.
2. G.S.N.Raju - "Antenna and Wave Propagation", 3rd Edition, Pearson Education, 2009.
3. Drabowitch.S, Papiernik. A, Griffiths .H.D ,Encinas . J, Smith. B.L – "Modern Antennas", 3rd Edition, Springer(India) pvt Ltd, 2007.
4. NPTEL Link – http:// www. cdeep.iitb.ac.in/nptel/ Electrical%20 &%20 Comm%20Engg /Transmission%20Lines%20and%20EM%20Waves/TOC.htm

Learning Outcomes:

Unit – I	The student will have an understanding of the basic concepts of antennae and their parameters.
Unit – II	The student will have an idea of different types of antennas, which may be used as elements in arrays, as feeds for reflector antennas.
Unit – III	The student will have an idea of different aspects of practical antennas including their properties and different modes of operation.
Unit – IV	The student will be able to define and broadly categorize the different types of radio wave propagation (Ground, space and sky wave propagation) and study the performance of antennas by measuring their different parameters like impedance, radiation pattern, etc.

COURSE CODE : BECCEC504R01 / MCSCEC504R01
COURSE NAME : DIGITAL COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the fundamental concepts of digital communication and the various techniques used in digital communication.

UNIT – I : Fundamentals of Digital Communication: 14 PERIODS

Basic concepts of digital communication – Block diagram – Sampling theorem – Types of sampling– aliasing – Nyquist criteria – Quantization – Signal to noise ratio of quantized pulse – uniform and non uniform quantization – companding(A-law and μ-law) Introduction to Channel Noise – Noise models – AWGN, Rayleigh, Rician channels - distortionless transmission - ideal filter – baseband and passband –Bandwidth dilemma - white noise – Power Spectral Density.

UNIT – II : Baseband Transmission and Detection: 15 PERIODS

Pulse Code Modulation – Delta Pulse Code Modulation (DPCM) – Delta modulation – Adaptive delta modulation – Delta sigma modulation
Detection: Baseband signal receiver - integrate and dump receiver - Peak signal to RMS noise output voltage ratio - probability of error - optimum filter - transfer function - white noise - matched filter - correlators.
Inter Symbol Interference: Ideal Nyquist channel - pulse shaping - raised cosine filter – Generalized form of correlative level coding (partial response signaling)-duo binary signaling – decoding – precoding - Eye patterns.

UNIT – III : Bandpass Modulation and Demodulation: 16 PERIODS

M-ary Modulation: signaling and performance – Generation and Detection: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Phase Shift Keying, Quadrature Amplitude Modulation, Differential PSK, MSK, GMSK – Signal space diagram – Probability of bit error, Bit error probability versus symbol error probability – Comparison and applications of various digital modulation techniques.

UNIT – IV : Multiple Access Techniques: 15 PERIODS

Allocation of the communications resource – Frequency division multiple access – Time division multiple access - communication resource channelization - performance comparison of FDMA and TDMA - Spread spectrum multiple access - Basic spread spectrum technique-Direct Sequence Spread Spectrum (DSSS) – Processing gain and performance. Pseudo noise sequences –properties of PN sequence – Spreading codes – Shift register generator, Gold codes.
Frequency Hop spread spectrum (FHSS) – slow and fast hopping – Processing Gain – Direct sequence vs Frequency hopping. – Performance of Spread Spectrum – DS in AWGN and Rayleigh Fading.

Text Books:

1. B. Sklar - "Digital Communication – Fundamentals and Application", Pearson education India, 2nd Edition, 2009.
2. Simon Haykin - "Digital Communications", John Wiley, 2009.

Suggested Readings:

1. B.P. Lathi and Zhiding – "Modern digital and analog communication systems",4th Edition, Oxford University Press, 2009
2. Taub, H; Schilling .D.L, Goutam saha– "Principles of Communication Systems", 3rd Edition, Tata McGraw Hill, 2008.
3. J.G.Prokias, Masoud salehi – "Digital Communications", 5th Edition, McGraw Hill, 2008.
4. Dr.K.N. Hari Bhat, Dr. D. Ganesh rao – "Digital communication – A simplified Appproach", 3rd Edition, Sanguine Publications, 2008.
5. Wayne Tomasi - "Electronics communication systems Fundamentals through Advanced", Pearson Printice Hall India, 5th Edition, 2004.
6. NPTEL Link – http:// freevideolectures.com/Course/2311/Digital-Communication

Learning Outcomes:

Unit – I	Learner will have an understanding of the concepts of digital communication and conceptual differences between analog and digital communications systems
Unit – II	Learner will have an understanding of baseband signal transmission and reception techniques
Unit – III	Learner will be able to analyze various bandpass modulation and demodulation techniques in terms of error rate and spectral efficiency.
Unit – IV	Learner will be able to identify issues and methods related to sharing of the communications resources. Learner will able identify and implement the most appropriate method based on the requirement of a digital communication system.

COURSE CODE : BECDEC501R01 / MCSDEC501R01
COURSE NAME : OPTICAL COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To provide the fundamental concepts of optical fibers, which have increasing applications in the area of information technology and communication, healthcare and life science, optical sensing, lightning, energy and manufacturing.
- To provide focus on the applications of optical communication techniques.

UNIT – I : Basics of Optical Fiber: 15 PERIODS

Block diagram of optical communication system – Optical windows in electromagnetic spectrum – Advantages of fiber optic communication – Free space optical communication system – Examples.

Refraction – Reflection-Snell's law – Critical angle and total internal reflection.
Meridional rays in optic fiber – Skew rays – Acceptance angle and numerical aperture – Mode theory in optical waveguide.

Fiber structure: Step index and graded index fiber – Monomode and multimode fibers; Glass fiber and plastic fiber – Number of modes in step and graded index fiber – Mode number- Signal attenuation and dispersion - Solitonic wave propagation concepts.

UNIT – II: Optic Sources and Detectors: 15 PERIODS

LEDs – DH structures – Materials – Internal, external and coupling quantum efficiencies – Semiconductor materials for optical sources – Surface emitting LED – Edge emitting LED – Modulation capability – Electrical and optical bandwidth – LASER principle – FP, DFB Laser diode structures – Temperature effects – Noise – Reliability considerations. Basic concepts of semiconductor optical amplifiers and EDFA operation.
Optical detectors – PIN diode – APD.

UNIT – III: Transmission and Reception: 15 PERIODS

Source to fiber power launching and lensing schemes, fiber joints, splicing techniques- Connectors and Optical Couplers.
Optical amplifier – Modulation : Analog and digital signal modulation – Receiver block diagram – Types of preamplifiers – Coherent detection – Noise in optical link – Power budget and bandwidth budget calculation.

UNIT – IV: Measurements and Applications : 15 PERIODS

Measurement of fiber attenuation – dispersion – refractive index profile – numerical aperture – fiber diameter – mode field diameter for monomode fibers – Principle of Optical Time Domain Reflectometry (OTDR) – Field measurements.
Point to point link – Wavelength Division Multiplexing – Application of fiber optic system in LAN – SONETs - Optical sensors – Temperature and pressure sensing.

Text Books:

1. John M. Senior - "Optical Fiber Communication: Principles and Practice", 3rd Edition, Prentice Hall India, 2008.
2. Gerd Keiser - "Optic Fiber Communication", 4th Edition, Tata McGraw Hill, 2008.

Suggested Readings :

1. Subir Kumar Sarkar – "Optic Fibers and Optic Fiber Communication Systems", 4th Edition, S.Chand, 2007.
2. J.H. Franz and V.K. Jain – "Optical Communications – Components and Systems", Narosa Publishing House, 2000.
3. R.Rajaraman - "Solitons and Instantons:An introduction to Solitons and Instantons in Quantum Field Theory", 4th edition, North Holland Publishing Company,1987.
4. NPTEL Link – http:// www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg /Optical%20Communication/TOC.htm

Learning Outcomes:

Unit – I	The learner will have an understanding of the concepts of propagation of light in optical fiber and the operation principles.
Unit – II	The learner will be able to understand the function of optical sources and detectors.
Unit – III	The learner will have an understanding of the principles of data transmission and reception in optical fiber.
Unit – IV	The learner will be able to understand the operating principles and uses of measurement devices and optical communication systems including wavelength division multiplexing, integrated optical systems and sensors.

COURSE CODE : BECDEC505R01 / MCSDEC505R01
COURSE NAME : BIOMEDICAL INSTRUMENTATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To provide an acquaintance of the physiology of heart, lungs, blood circulation and respiration.
- To understand the principles and operations of various sensing and measurement devices which are used to acquire various electrical signals from human body
- To provide awareness of electrical safety of medical equipments.
- To provide knowledge of various clinical devices.

UNIT – I: Physiology and Bioelectric signals: 15 PERIODS

Basic cell functions- cardiovascular system - nervous System -Musculo-skeletal system- Respiratory system- categories of biomedical instrument- Electrode theory - half cell potentials, electrodes tissue interface, Bipolar and unipolar electrodes - Types of electrodes-Micro, needle and surface electrodes-origin and measurement of Bioelectric signals ECG – Lead configuration – EEG- Lead configuration - EMG machines recording system.

UNIT – II : Transducers and Biomedical Measurement: 15 PERIODS

Resistive transducers -Inductive Transducers - Capacitive Transducers - Photoelectric Transducers - Piezoelectric Transducers - Chemical Transducer – Biochemical Measurement - pH, pO_2, pCO_2 calorimeter - Spectro photometer types - flame photometer - auto analyzer - blood cell counter

UNIT – III: Biological Parameters Measurement : 15 PERIODS

Respiration rate - heart beat rate – Temperature - cardiac output indicator - dye-thermal-impedance-ultrasound methods - O_2, CO_2 measurements - spirometry- Measurement of Blood pressure - Measurement of Blood flow- Plethysmography

UNIT – IV: Clinical Instruments: 15 PERIODS

Functional neuromuscular simulation – Physiotherapy – Electro surgical unit –Thermography – Recording and clinical application-Diathermy — Nerve stimulator- Heart – Lung machine –Haemo Dialyser unit - Lithotripsy - Principles of Cryogenic technique and application – Laparoscopy - Oximeter.

Text Books:

1. John.G.Webster – "Medical instrumentation Application & Design", 3rd Edition John Wiley & sons 2009.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer – "Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2008.

Suggested Readings:

1. R.S. Kandpur – "Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw Hill, 2003.
2. L.A. Geddes and L.E. Baker – "Principles of Applied Biomedical Instrumentation", 3rd Edition, John Wiley, 1989.

Learning Outcomes :

Unit – I	The students will have an understanding of the issues and considerations involved in the design and development of biomedical instrumentation for clinical measurement and biomedical research
Unit – II	The students will have an understanding of the basic principles and operation of biopotential electrodes, biomedical sensors and biopotential amplifier.
Unit – III	Learners will be able to measure biomedical parameters and also can identify artifacts.
Unit – IV	The students will have an understanding of the working of clinical instruments

COURSE CODE : BECDEC506 / MCSDEC506
COURSE NAME : VIRTUAL INSTRUMENTATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the concepts of designing virtual instruments for various engineering applications.

UNIT – I: Review of Virtual Instrumentation: 14 PERIODS

Historical perspective – Advantages- Block diagram and architecture of virtual instrument - Data-flow techniques - Graphical programming in data flow - Comparison with conventional programming – Components of a VI – Block Diagram – Front Panel – controls – Indicators - Connector Pane – Terminal icons – wires.

UNIT – II: Graphical Programming Environment in Virtual Instrumentation: 16 PERIODS

VI programming techniques: VIs and sub VIs – Structures – For and while Loops – Shift Registers – Feedback Node – Timed Loop - Graphs and charts - Arrays and Clusters - Case structure – Flat Sequence structure – Stacked Sequence structure - Diagram Disable structure – Expression Node - Formula node – Mathscript Node - Local and global variables - String and file I/O.

UNIT – III: Data Acquisition and Instrument interfaces : 16 PERIODS

Data acquisition Basics: ADC - DAC – Scanning types – Software and Hardware Triggering - AIO, DIO - counters & timers .

Common instrument interfaces: current loop - RS232 – RS422 - RS 485 – VISA Functions - Parallel Port - GPIB – System buses - Interface buses – USB – PCMCIA –VXI – SCXI –PXI.

UNIT – IV: Analysis Tools and Applications: 14 PERIODS

Use of analysis tools : Signal convolution - Auto correlation and Cross correlation -Power spectrum – FFT and IFFT.

Applications : Waveform Generation - Realization of digital circuits - Realization of analog and digital modulation techniques – Image display – Graphical object representation in 3D.

Text Book:

1. Jeffrey Travis – "LabVIEW for Everyone", 2nd Edition, Prentice Hall(PTR), 2002.

Suggested Readings:

1. S.Sumathi and P.Surekha – "LabVIEW based Advanced Instrumentation Systems", Springer , Verlag Berlin Heidelberg, 2007.
2. Robert H. Bishop - "Learning with Lab-view", 4th Edition, Prentice Hall, 2006.
3. Gary W. Johnson, Richard Jennings – "Lab-view Graphical Programming", 3rd Edition, McGraw – Hill Professional Publishing, 2001.
4. LAB VIEW User Manual, National Instruments, 2010
5. LAB VIEW Measurements Manual, National Instruments, July 2000 Edition, Part Number 322661A-01.
6. S. Gupta and J.P Gupta - "PC Interfacing for Data Acquisition and Process Control", Instrument society of America, 1994.

Learning Outcomes:

Unit – I	The learners will be able to differentiate traditional and virtual instruments. They will also be able to understand the fundamental principles of virtual instruments.
Unit – II	The learners will be able to design virtual instruments with the help of fundamental programming structures.
Unit – III	The learners will be able to understand the intricacies of data acquisition with virtual instruments and also the various PC based data interfaces like USB, Serial port etc.,.
Unit – IV	The learners will be able to develop applications using virtual instruments covering diverse domains such as communication, signal processing and computer graphics.

COURSE CODE : BECDEC507 / MCSDEC507
COURSE NAME : TELEVISION ENGINEERING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the functioning of conventional and recent video systems along with the different video encoding/decoding techniques.

UNIT – I: Basic Television System and Monochrome T.V. Cameras: 14 PERIODS

Sound and picture transmission – Scanning process – Interlaced scanning – Composite video signal – Vestigial Side Band (VSB) transmission – Channel BW – Television standards.

T.V. Cameras : Principles of working and constructional details of Image orthicon – Vidicon – Plumbicon – Silicon diode array vidicon – Solid state image scanners. Block schematic study of a typical T.V. Transmitter.

[

UNIT – II : Monochrome Picture Tube and Receivers: 16 PERIODS

Picture tube: Monochrome picture tube principles – Picture tube characteristics – Picture tube control circuits – Gamma correction.

Television Receiver : Television receiver block diagram – Antenna – RF section – Vestigial side band correction – Video IF Amplifier – Video detector- video amplifier-picture tube controls-sound section-sync processing and AFC circuit – vertical and horizontal deflection circuits –ETH generation-Remote control and special circuits –Types of tuning – picture tube boosters- Automatic brightness control – Instant on circuitry.

UNIT – III: Colour Media: 15 PERIODS

Colour fundamentals – Principles of additive and subtractive colour mixing –Generation of RGB signals – Compatibility of monochrome and colour television – BW for colour signal transmission - Representation and Manipulation - 2D images as signals -Dither in images - 2D Resampling- Colour - Image Processing- Formats and Standards: Tagged Image File Format (TIFF), Graphics Interchange Format (GIF) - Digital Display Systems - Video RAM, Frame Buffers - Animation Technology - Flipping, Colour Cycling – Musical Instrument Digital Interface (MIDI) files – Compression – Data, Music, Audio, Video, Image – Storage technology –Direct To Home(DTH).

UNIT – IV : Television Applications and Modern Television: 15 PERIODS

Teletext – Satellite TV – CCTV – Cable TV – Video conferencing – Video test signals – Video compression techniques – Digital TV – MAC – 3D TV – High Definition (HD) TV

Display systems: Thin Film Transistor (TFT), Liquid Crystal Display (LCD), Plasma and Touch Sensitive Screen (TSS)

Text Book:

1. R.R. Gulati – "Monochrome and Colour Television", New Age International (P) Ltd. 2nd Edition, 2006.

Suggested Readings:

1. R.R. Gulati – "Modern Television Practice: Principles Technology and servicing", New Age International (P) Ltd. 2nd Edition, 2006.
2. Arvind M. Dhake – "Television and Video Engineering", 2nd Edition, Tata McGraw - Hill, 2005
3. Michael Robin and Michael Poulin – "Digital Television Fundamentals", 2nd Edition Tata McGraw-Hill, 2000.

Learning Outcomes :

Unit – I	The learner will have an understanding of the basic concepts of capturing and transmission of videos and also channel allocations for different TV standards available.
Unit – II	The learner will get insight on functioning of individual blocks of receiver section of black and white TV.
Unit – III	The learner will be able to understand the fundamentals of colour TV and encoding schemes for different media.
Unit – IV	The learner will get the impact of latest TV systems being developed and it's availability to the user.

COURSE CODE : BECDEC508 / MCSDEC508
COURSE NAME : POWER ELECTRONICS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the switching behavior and design of power electronic circuits such as DC/DC, AC/DC, DC/AC and AC/AC converters.

UNIT – I: POWER SEMI-CONDUCTOR DEVICES: 12 PERIODS

Study of switching Devices- Power diodes – Thyristor: Principle of operation - I-V characteristics-Switching characteristics-Gate characteristics – Ratings and specifications – Protection against high di/dt and high dv/dt – Turn on and turn off methods – Gate triggering circuits.
Power semiconductor devices other than SCRs – Triac, power transistor, MOSFET, IGBT, GTO,MCT – Physics of device operation and steady state characteristics.

UNIT – II: PHASE-CONTROLLED CONVERTERS: 15 PERIODS

Principle of Phase control –Single phase Half wave phase controlled converters – Freewheeling – Single phase semi-converters –Full wave phase controlled converters –Line commutated inverters - Operation with R, RL and RLE load -Estimation of load voltage, load current and source power factor under continuous current conduction – Performance parameters-Effect of source inductance-Three phase half controlled and fully controlled converters –Operation and waveforms for continuous current operation-Dual converters – Circulating and non-circulating modes of operation.

UNIT – III: DC TO DC CONVERTERS AND AC TO AC CONVERTERS: 18 PERIODS

DC Chopper using devices other than SCRs(Power MOSFET,IGBT,GTO): Principle of operation – Control strategies – TRC & CLC types – One quadrant, two quadrant and four quadrant chopper
Switched mode power converters– Buck converters — Boost converters – Buck boost converters – Continuous and discontinuous conduction mode –Concept of resonant converters.
AC voltage controllers –Phase control – Single phase ac voltage controller with R, RL load – Three phase ac voltage controllers-Matrix converters
Cyclo converters – Principle of operation – Single phase cycloconverter (operation and wave form only).

UNIT – IV: INVERTERS: 15 PERIODS

Inverters using devices other than SCR (Power MOSFET,IGBT,GTO): Classification of inverters – Voltage source inverters – Single phase half bridge and full bridge inverters – Current source inverters – Three phase voltage source inverters – Three phase current source inverters-Resonant Inverters-Performance parameters- Generation of control pulses-Microprocessor based implementation.
Voltage control and harmonic reduction in inverters – Control of dc voltage supplied to the inverter – PWM inverter – Single pulse, multiple pulse and sinusoidal pulse width modulation – Unipolar and bipolar PWM - Implementation of PWM in single phase bridge inverters – Harmonic elimination by PWM – Harmonic reduction by transformer connection – Harmonic reduction by stepped wave inverter.

APPLICATIONS: HVDC-Regulated power supply-UPS(Qualitative approach only)-Grid connected photovoltaic and wind Energy system- Power Electronic system in communication.

Text Books:

1. Rashid, M H "Power Electronics" Pearson education, 3rd edition, 2009.
2. P S Bimbhra "Power Electronics" Khanna Publishers, New Delhi, 1st edition, 2006.

Suggested Readings:

1. Ned Mohan, Tore M Undeland , William P Robbins "Power Electronics – converters, application and design" John Wiley & Sons, New York, 2007.
2. M D Singh "Power Electronics" Tata McGraw Hill, New Delhi, 1st edition, 2008.
3. P.C.Sen " Power Electronics" Tata McgrawHill,2001.
4. M.H.Rashid, " Power Electronics Hand Book- Devices, Circuits and Applications" , 3rd Edition,Elsevier, 2011.
5. Thesis - "Power Electronics System Communications" by Ivana Milosavlevic, Master of Science in Electrical Engineering,Viginia Polytecnic Institute and state University.
6. NPTEL Link – http://www.youtube.com/watch?v=1Auay7ja2oY.

Learning Outcomes :

Unit – I	Students will have better understanding of the basic principles of switching characteristics of different power semiconductor devices.
Unit – II	Students will have an understanding of the operating principles of different types of power electronic converters.
Unit – III	Students will have an understanding of the operating principles of different types of dc-dc converters, cyclo converters.
Unit – IV	Students will have an understanding of the operating principles of different types of inverters and applications of power electronics.

COURSE CODE : BECCEC505R02 / MCSCEC505R02
COURSE NAME : MICROPROCESSORS LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To develop assembly language programs to command 8086, 80386 and ATOM processors for various applications.

List of Experiments

Programs on 8086

1. Programs on byte and bit oriented ALU operations
2. Programs on Arrays
3. Programs on Code conversions
4. Interrupt programming using Non-Maskable Interrupt (NMI)
5. Programming 8255 in various modes.
6. Interfacing Traffic light controller
7. Interfacing Character LCD

Programs on ATOM board

8. Detailed study of Atom board
9. Matrix Multiplication
10. Counting external events.
11. Interfacing DAC
12. Interfacing Stepper motor
13. Interfacing Matrix Keypad
14. Task Switching in Protected Mode
15. Paging in Protected Mode

Learning Outcomes:

Expt. No	Outcome
1.	The learners will be able to handle and differentiate bit and byte oriented operations with Arithmetic and Logic Unit(ALU)
2.	The learners will be able to design and simulate searching and sorting programs by accessing array of data using direct and indirect addressing modes of opertion.
3.	The learners will be able to design and simulate the different types of code conversions and will be familiarized with masking concepts.
4.	The learners will be able to handle interrupts, their vector locations, subroutines and differentiate between hardware, software interrupts, maskable and nonmaskable interrupt concepts.
5.	The learners will be able to identify the need of 8255 and simulate the various operating modes available in it.
6.	The learners will be able to interface 8086 with traffic light controller using 8255 and simulate various traffic conditions.
7.	The learners will be able to interface 8086 with LCD using 8255 and display characters on it for various conditions.
8.	The learners will be able to study the features and architectural design of ATOM board.
9.	The learners will be able to access array of data using 80386 instructions in ATOM board and simulate matrix operations like additon, subtraction and multiplication.
10.	The learners will be able to design counters for internal and external events occurred using 80386 instructions in ATOM board.
11.	The learners will be able to interface GPIO's of ATOM board with stepper motor for various rotations and step angles.
12.	The learners will be able to interface GPIO's of ATOM board with matrix keypad and display row number, column number and the key pressed
13.	The learners will be able to interface GPIO's of ATOM board with DAC to display various waveforms in CRO
14.	The learners will be able to operate ATOM board to perform Task Switching in Protected Mode
15.	The learners will be able to operate ATOM board to perform Paging in Protected Mode

COURSE CODE : BECCEC506 R01 / MCSCEC506R01
COURSE NAME : COMMUNICATION LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To understand different analog and digital techniques used in communication systems as well as to provide hands-on experience to design various communication circuits

List of Experiments

1. Amplitude modulation and demodulation
2. Frequency modulation and demodulation
3. Signal Reconstruction from Samples
4. Pulse amplitude modulation, Pulse width modulation and Pulse position modulation and Demodulation
5. Amplitude shift keying (ASK) and Frequency shift keying (FSK)
6. Binary Phase shift keying (BPSK), Quadrature Phase shift keying (QPSK) and Quadrature Amplitude Modulation. (QAM)
7. Time division multiplexing (TDM)
8. Manchester coding and Decoding
9. Fiber optic communication-propagation loss and bending loss
10. Noise generator
11. Pulse Code Modulation and Demodulation
12. Differential Pulse Code Modulations and Demodulation

Learning Outcomes:

Expt. No	Outcome
1.	The learners will be able to design and construct the circuit for amplitude modulation and demodulation
2.	The learners will be able to design and construct the circuit for frequency modulation and demodulation
3.	The learners will be able to analyze the reconstruction of the signal from its samples .
4.	The learners will be able to design and construct Pulse amplitude modulation, Pulse width modulation and Pulse position modulation and Demodulation circuits.
5.	The learners will be able to design and construct Amplitude shift keying (ASK) and Frequency shift keying (FSK) circuits.
6.	The learners will be able to analyze Binary Phase shift keying (BPSK), Quadrature Phase shift keying (QPSK) and Quadrature Amplitude Modulation(QAM) circuits.
7.	The learners will be able to understand how many users can share the same channel based on time
8.	The learners will be able to understand Manchester coding and Decoding Scheme
9.	The learners will be able to measure Fiber optic communication-propagation loss and bending loss
10.	The learners will be able to design and construct Noise generator
11.	The learners will be able to understand Pulse Code Modulation and Demodulation circuits
12.	The learners will be able to understand Differential Pulse Code Modulations and Demodulation circuits

COURSE CODE : BECCTP 507 R02 / MCSCTP 507 R01
COURSE NAME : HR SKILLS-I
TOTAL PERIODS PER WEEK : 02
CREDITS : 02

Course Objective:

To emphasize, impart and improve soft skills of the learner.

S.NO	TOPICS	NO. CLASSES
1	Self Introduction	2
2	Impromptu	3
3	Role Play	2
4	SWOT Analysis	2
5	Body Language	1
6	Product Launch	3
7	Person I admire / Book I Like / If I were	2
8	Self Confidence (Infosys Exercise)	1
9	Mock Press	2
10	Lost at Sea	1
11	Out of Box Thinking (Creativity & Innovative Thinking)	1
12	Debate on Current Affairs	3
13	General Quiz	1
14	Quiz on C / C++/ IT Concepts	2
15	Semester Practical	3
16	Semester Theory Exam	1
TOTAL		**30**

Learning Outcomes:

Self Introduction	The learner will be able to successfully introduce himself before others.
Impromptu	The learner realizes the importance of presence of mind and react sharply and swiftly.
Role Play	The learner will understand the importance of communication skill and presence of mind
SWOT Analysis	Students are encouraged to do a self introspection of their strengths, weaknesses, opportunities and threats
Body Language	The learner realizes the importance of body language in the day to day communication
Product Launch	The learner understands the importance of marketing skills and the need for sharpening the skill.
Person I admire/Book I like/If I were	This inculcates the habit of reading and know about the greatness of great people.
Self confidence	Students will get to know the importance of self confidence and the ways to improve it.
Mock Press	The learner will enhance the answering skills and the ability to articulate his thoughts.
Lost at sea	The learner will understand the importance of team skills and problem solving skills.

Out of Box thinking	The learner will develop lateral thinking and be encouraged to think differently.
Debate on Current Affairs	The learner will be exposed to the happenings around the globe through a debate
Quiz on C, C++	The learner will become familiar with the basics of C and C++ programming to face job interview.

Scheme of Study and Syllabi for VI semester of
B.Tech. Electronics & Communication Engineering Programme
(Common with)
M.Tech. Communication Systems (5 -Year Integrated) Programme

S E M E S T E R – VI

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCEC 601R01 / MCSCEC 601R01	Microcontrollers	4	-	-	4	4
02.	BECCEC 602R01 / MCSCEC 602R01	Digital Signal Processing	3	1	-	4	4
03.	BECCEC 603 R01 / MCSCEC 603 R01	Microwave Engineering	4	-	-	4	4
04.	BECCEC 604 R01 / MCSCEC 604 R01	Control Engineering	4	-	-	4	4
05.		Department Elective V	4	-	-	4	4
06.		Department Elective VI	4	-	-	4	4
07.	BECCEC 605R01 / MCSCEC 605R01	Microcontroller Laboratory	0	-	3	3	2
08.	BECCEC 606 R01/ MCSCEC 606 R01	Microwave Laboratory	0	-	3	3	2
09.	BECCTP 607 R02 / MCSCTP 607 R01	HR Skills-II	2	-	-	2	2
		Total	**25**	**1**	**6**	**32**	**30**

List of Departmental Electives for VI Semester

BECDEC 602 R01 / MCSDEC 602 R01 - Satellite Communication
BECDEC 604 R01 / MCSDEC 604 - Real Time Operating System (RTOS)
BECDEC 605 R01 / MCSDEC 605 R01 - Neural Networks and Fuzzy Logic
BECDEC 606 / MCSDEC 606 - RADAR Engineering

COURSE CODE : BECCEC601R01 / MCSCEC601R01
COURSE NAME : MICROCONTROLLERS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To provide a comprehensive understanding of the hardware architecture and programming concepts both (assembly and embedded C languages) and to develop embedded systems using AVR & ARM based microcontrollers.

UNIT – I : ATmega8 Microcontroller: 16 PERIODS

Introduction to Microcontroller – Comparison of Microcontrollers and Microprocessor – AVR CPU Core – AVR ATmega8 Memories – System Clock and Clock Options – Power Management and Sleep Modes – System Control and Reset – Interrupts – External Interrupts – I/O Ports – Timer / Counter – Serial Peripheral Interface – USART – Analog Comparator – A/D Converter – Memory Programming.

UNIT – II: ATmega Programming: 14 PERIODS

Instruction Set of ATmega8 – Addressing Modes – Assembly Coding and C Coding for Timer - Counter – Input Capture Unit (ICU) – Output Compare Unit (OCU) – PWM - Interrupts – Analog to Digital Convertor – Analog Comparator – USART – Serial Peripheral Interface - Interfacing Applications: LCD – Keypad.

UNIT – III : Introduction to ARM7 Core 14 PERIODS

RISC and ARM design philosophy – ARM7TDMI core architecture - ARM state register set – THUMB state register set – Pipeline – Exceptions, Interrupts and vector table - ARM-Thumb Interworking - ARM instruction set - THUMB instruction set - Architecture Revisions.

UNIT – IV: Introduction to ARM based Microcontroller: LPC2148 16 PERIODS

Architectural Overview – Block diagram - Memory map.
On-chip Peripherals: GPIO – Timer – On-chip DAC – Watch Dog Timer – Real Time Clock – Vectored Interrupt Controller – Sample assembly programs using ARM and THUMB instruction set.

Text Books:

1. AVR ATmega8 Datasheet, 2011.
2. Andrew N. Sloss, Dominic Symes, Chris Wright - "ARM System Developer's Guide: Designing and Optimizing System Software", Elsevier Inc, 2004.

Suggested Readings:

1. LPC214X User Manual – Revision 4, 2012.
2. ARM7TDMI Technical Reference Manual, 2004.
3. NPTEL Link – http://nptel.iitg.ernet.in/ Elec _ Comm_ Engg / IIT % 20Kanpur/ Microcontrollers %20and%20Applications.htm.

Learning Outcomes:

Unit – I	Students will have an in-depth understanding of the core architecture, power management and on-chip peripheral functionality of 8-bit AVR microcontroller
Unit – II	The learner will be able to develop application codes for AVR devices in assembly and embedded C languages involving on-chip and off-chip peripherals
Unit – III	The learner will be able to understand the design of enhanced ARM7 core architecture and function of ARM and THUMB assembly instruction set
Unit – IV	Students will have an understanding of features in ARM7 based microcontroller architecture. Also, the learner will be able to write assembly programs using ARM and THUMB instruction set

COURSE CODE : BECCEC602R01 / MCSCEC602R01
COURSE NAME : DIGITAL SIGNAL PROCESSING
LECTURE PERIODS PER WEEK : 03
TUTORIAL PERIOD PER WEEK : 01
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the fundamental concepts, mathematical tools, design techniques and realization structures of digital signal processing schemes

UNIT – I : Discrete Transforms and Realization Structures: 15 PERIODS

Review of DTFT-Discrete Fourier Transform - Properties – Computational complexity of DFT – Frequency analysis of signals using DFT
Fast Fourier Transform(FFT) - Decimation-In-Time(DIT)FFT algorithm – Decimation-In-Frequency(DIF)FFT algorithm – Inverse FFT .
Frequency domain characteristics of LTI systems – response to complex exponential – steady state response to periodic input signal- response to aperiodic input signal – LTI system as frequency selective filters – Inverse system & deconvolution – minimum phase,maximum phase and mixed phase system – system identification - structures for realization of discrete time system- FIR - IIR.

UNIT – II : Digital Filters Design: 18 PERIODS

Symmetric and Antisymmetric FIR filters–Design of Linear Phase FIR filters using Hanning,Hamming , Kaiser windows and frequency sampling method.
Design of IIR Digital filters– Butterworth–Chebyshev filters–Bilinear Transformation – Impulse Invariant Transformation-Digital frequency transformation.

UNIT– III : Finite Word Length Effects in Digital Filters and Multirate Digital Signal Processing: 13 PERIODS

Representation of numbers - Quantization of filter coefficients - Round-off effects in digital filters – Signal Scaling.
Introduction to multi rate digital signal processing – Decimation by a rational factor D- Interpolation by a rational factor I – Sampling rate conversion by an integer factor (I / D) – Polyphase filters for decimator.

UNIT – IV : Power Spectrum Estimation and Optimum Linear Filters: 14 PERIODS

Wiener-Khintchine theorem - AR ,MA and ARMA processes for power spectrum estimation – White noise – Relationship between autocorrelation and model parameters- Yule Walker equations – Periodogram – Parametric methods of power spectrum estimation by Burg method-Non parametric methods of power spectrum estimation by Barlett method , Welch method and Blackman Tukey method – Wiener filter for filtering and prediction- Linear estimation problem – FIR wiener filtering.

Text Books:

1. John G.Proakis ,DimitrisG.Manolakis and Sharma – "Digital Signal Processing-Principles, Algorithms and Applications", 4th Edition, Pearson education, 2006.
2. Emmanuel C. Ifeachor, Barrie W. Jervis - "Digital Signal Processing: A Practical Approach", 2nd Edition, PHI, 2002.

Suggested Readings:

1. Schaums Outlines - "Digital Signal Processing", 2nd Edition, 2012.
2. Rabiner& Gold –"Theory and Application of Digital Signal Processing", 4th Impression, Pearson, 2009.
3. SanjitK.Mitra – "DSP - A Computer Based Approach", McGraw Hill, 3rd edition, 2007.
4. NPTEL Link – http://www.youtube.com/watch?v=6dFnpz_AEyA.

Learning Outcomes:

Unit – I	The learners will have an understanding of the evolution of FFT algorithm, use of this algorithm to filter digital signals in the frequency domain, and calculate its complexity. In addition, the learner will have an understanding of frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform.
Unit – II	The learners will be able to design FIR & IIR digital filters for extracting and modifying signals.
Unit – III	The learner will have an understanding of finite word length effects. In addition, the learner will be able to implement multirate digital signal processing algorithms.
Unit – IV	The learners will be able to estimate the power spectral density (PSD) of a time-discrete stochastic process using non-parametric and parametric methods and show some insight into the positive and negative aspects of the different approaches.

COURSE CODE : BECCEC603R01 / MCSCEC603R01
COURSE NAME : MICROWAVE ENGINEERING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To introduce the essential concepts of microwave engineering and help the learners understand various tube-based and solid state active and passive devices and their operation.

UNIT – I: Microwave Network Theory and Passive Devices: 16 PERIODS

Symmetrical Z and Y matrices for reciprocal networks – Scattering matrix representation of multiport network – Properties of S parameters – Applications to Two-port amplifier.
Cavity resonators : Coaxial and Re-entrant types.
Terminations – Attenuators – Phase changers – Directional coupler – Hybrid junctions.
Microwave propagation in ferrites – Faraday rotation – Ferrite devices – Gyrators, isolators and circulators – S matrix description and applications.

UNIT – II : Microwave Tubes: 17 PERIODS

High frequency limitations of conventional tubes – Klystrons – Bunching process – Multicavity Klystron – Output power and efficiency – Reflex Klystron – Modes – Admittance spiral – Output power and efficiency – Helix type Travelling Wave Tube – Backward wave oscillators – Travelling wave magnetron – Principle of operation and characteristics – Hull cut-off equations – Frequency pushing and pulling.

UNIT – III : Microwave Solid State Devices: 15 PERIODS

Microwave transistors – Physical structures – Principles of operation – Microwave characteristics – Power and frequency limitations – Transferred Electron Device (TED) – Gunn diode – Avalanche Transit Time Devices : IMPATT and TRAPATT devices – Principles of operation and performance – PIN diode, Tunnel diode, Varactor diode.
Parametric devices : Non-linear reactance and Manley-Rowe power relations – MASER.

UNIT – IV : Microwave Integrated Circuits and Microwave Measurements: 12 PERIODS

Microwave Integrated Circuits : Introduction – Materials – Monolithic Microwave Integrated Circuit (MMIC) growth – Hybrid integrated circuit fabrication.
Basic microwave measurements (Frequency, wavelength, attenuation, power, impedance and VSWR).

Text Books:

1. David M Pozar – "Microwave Engineering", 3rd Edition, John Wiley Publishers, 2008.
2. M. Kulkarni – "Microwave and Radar Engineering", 3rd Edition, Umesh Publications, 2003.
3. Samuel Y. Liao – "Microwave Devices and Circuits", 3rd Edition, Pearson education, 2003.

Suggested Readings:

1. Annapurna Das and Sisir K.Das – "Microwave Engineering", 2nd Edition, Tata McGraw - Hill, 2009.
2. R.E. Collin – "Foundations for Microwave Engineering", 3rd Edition, John Wiley & Sons, 2008.

Learning Outcomes:

Unit – I	The learners will have an understanding of the microwave concepts, seamless transition from circuit theory to field theory, as well as passive devices.
Unit – II	The learner will be able to understand the principles, structure and operation of tube-based active sources in the microwave regime.
Unit – III	The learner will have a thorough understanding of the structure, operation and applications of various semiconductor microwave devices.
Unit – IV	The learner will have an understanding of the materials used in Monolithic Microwave Integrated Circuits and the fabrication of the same. In addition, the learner will also get acquainted with various measurement techniques.

COURSE CODE : BECCEC604R01/ MCSCEC604R01
COURSE NAME : CONTROL ENGINEERING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the response of a system to different inputs both in time and frequency domain
- To understand the stability aspects and state variable approach of systems

UNIT – I: Modelling of Physical Systems and Control System Components: 15 PERIODS

Introduction – Open and Closed Loop Systems – Transfer Function – Definitions – Analogous Systems (F – V Analogy) – Block Diagram Reduction – Signal Flow Graphs – Mason's Formula (Without Proof) – Problems and Examples.
Control System Components – Stepper Motors – Synchros – Transfer Function of DC Motors .

UNIT – II : Time and Frequency domain response: 15 PERIODS

Time Domain Analysis – Test Signals – Step Response of First Order and Second Order Systems-Time Domain Specifications-Types and Order of a System – Steady State Error – Error Constant – Generalized Error Coefficients.
Frequency Response – Frequency Domain Specifications –Bode Plot-Polar plot-gain margins and Phase margins.

UNIT – III : Stability and Root locus: 15 PERIODS

Stability Definitions-Characteristics Equation- Location of Roots in the S Plane for Suitability- Routh Hurwitz Criterion for Stability-Nyquist stability criterion - Inverted pendulum stability problem.
Root Locus technique-Rules for the construction of the Loci-Examples of Root locus plot-Determination of critical gain.

UNIT – IV : Compensator Design and State Variable Approach : 15 PERIODS

Compensator design using frequency response and root locus technique(lead-lag)-Design problems.
SISO and MIMO Systems – State Space Analysis of Physical Systems –Electrical - State and Output Equation – Matrix Representation – System Classification – Relationship Between Transfer Function and State Model – Problems and Examples.

Text Books :

1. Norman.S.Nise - "Control systems Engineering", 6th edition, John Wiley, 2010.
2. K.Ogata - "Modern control Engineering", Prentice Hall of India, 2007
3. B.C.Kuo - " Automatic control systems", Prentice Hall of India, 2003
4. Nagrath and Gopal – "Control System Engineering", 2nd edition, Wiley Eastern Ltd, 2003.

Suggested Readings :

1. S.Seshadhri and B.Subhathra -"Control systems" Tata McGraw Hill Publications,2012
2. A.Ramakalyan -"Control Engineering-A comprehensive Foundations",Vikas publishing house Pvt ltd, 2003
3. M.Gopal - "Control Systems-principles and design,"Tata McGraw Hill Education, 2002.
4. Jacqueline Wilkie, Michael Johnson and Reza Katebi - "Control Engineering",Palgrave-macmillan Publications, 2001.
5. NPTEL Link – http://freevideolectures.com/Course/2337/Control-Engineering.

Learning Outcomes:

Unit – I	The learners will have an understanding of the concept of feedback and different methods of representation of a system
Unit – II	The learners will have an understanding of different classifications of system and the responses of the same to different test inputs. They will be able to analyze different frequency response characteristics of a system
Unit – III	The stability analysis of the system based on different criterion such as Routh Hurwitz, Nyquist and root locus technique is learnt.
Unit – IV	The learners will be able to understand the design of control system using compensators. They will also be able to analyze state space analysis for multi input and multi output system.

COURSE CODE : BECDEC602R01 / MCSDEC 602 R01
COURSE NAME : SATELLITE COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the various sub-systems of satellite communication system
- To understand the basic concepts, design challenges, maintenance, operation and multiple access techniques involved in satellite communication system

UNIT – I : Satellite Orbits and Launching: 14 PERIODS

Introduction – Active and passive satellites – Frequency allocation – Types of orbits – Low Earth Orbit(LEO)-Geostationary Earth Orbit (GEO) - Medium Earth Orbit (MEO) - Highly Elliptical Orbit(HEO) - Kepler's laws – Orbital elements – Orbit period and velocity – Look angles and slant range – Orbital perturbations – Station keeping.
Rocket propulsion – Launch vehicles – Multi stage vehicles – Launch sequence – Testing and facilities.

UNIT – II: Space Segments: 15 PERIODS

Block diagram – Communication satellite configuration – Subsystems – Power supply – Attitude control – TT and C-Transponder – Reliability – Common antenna types – Spot beams – Dual polarization – Frequency re-use.

UNIT – III: Earth Segment: 15 PERIODS

Block diagram – Earth station site selection – G/T and Measurement – Antenna types – HPA, LNA and redundancy configurations – Up and down converters – Reliability – Monitoring and control – TVRO – Transmit and receive types – VSAT – Mobile and transportable Earth stations – Link design – Up and down links.

UNIT – IV :Access Techniques and Satellite Applications: 16 PERIODS

Multiple access techniques – FDMA, SS-FDMA, FDM-FM-FDMA, TDMA, SS-TDMA, DAMA, SPADE systems – Spread spectrum techniques – CDMA – Packet satellite communication – ALOHA schemes – Pure, slotted finite population, controlled and R-packet satellite networks – Applications – Remote sensing – GIS – GPS.

Text Books:

1. Dennis Roddy – "Satellite Communications", 4th Edition, Tata McGraw Hill, 2006.
2. M. Richharia – "Mobile Satellite Communication – Principles and Trends", Pearson Education, 2003.

Suggested Readings:

1. Tri T.Ha – "Digital Satellite Communication", Macmillan Publishing Co. and Collier Macmillan Publishers and Tata McGraw Hill, 2009.
2. T. Pratt and G.W`. Bostion – "Satellite Communications" , John Wiley and Sons, 2001.

Learning Outcomes:

Unit – I	Learner will be able to understand the concept of satellite orbits, launching sequence and orbital parameters.
Unit – II	The learner will have an understanding about the role of different sub-systems of the space segment.
Unit – III	The learner will have an understanding about the different types of earth stations and their functioning. They also will have an insight in the satellite link design
Unit – IV	Learner will be able to identify issues and methods related to satellite resource sharing. Learner will also have an understanding of important applications of satellite communication

COURSE CODE : BECDEC604R01 / MCSDEC604
COURSE NAME : REAL TIME OPERATING SYSTEM (RTOS)
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To provide in-depth understanding of kernel objects, memory management procedures, event handling and resource allocation models in-turn to design real time multitasking systems using RTOS.

UNIT – I: Introduction to RTOS: 15 PERIODS

Definition: OS – RTOS – Need for OS - Characteristics and types of RTOS - Scheduling algorithm (Round-robin, Pre-emptive priority) - Inter Process Communication(IPC): Tasks - Tasks states – Operation - Task structure - Semaphores (Binary, Counting, Mutex) - Message queues – Pipes – Event – Signal - Conditional variables.

UNIT – II: Timer Services and Real Time Memory Management: 15 PERIODS

Timing services: Real time clock – Programmable Interval Timer (PIT) - Timer Interrupt Service Routine (ISR) - software Timer – Timing wheels.
Process Stack Management: Task Control Block (TCB) - Managing stack – Run time ring buffer - Maximum stack size -Multiple stack arrangements - TCB model.
Dynamic Memory allocation: Swapping –Overlays – Multiprogramming with Fixed Task (MFT) – Multiprogramming with Variable Task (MVT) - Demand Paging - Replacement Algorithm - Memory locking - Working set – Real Time Garbage collections -Contiguous file systems.

UNIT – III: Exceptions and Interrupts: 15 PERIODS

Introduction – Definitions - Polled loop systems – Applications – Programmable Interrupt Controller (PIC) - Exception classification, Priorities and Processing: Installing handlers - Saving processor status - Loading and invoking handlers - Nested exceptions and stack overflow – Handlers – Exception Service Routine (ESR) Vs ISR - Execution timing -Spurious interrupts.

UNIT – IV: Design using RTOS: 15 PERIODS

Basic Design using RTOS: Overview, principles, Design example: Underground tank monitoring system.
Design problems: Critical session – Resource classification – Resource request models - Deadlocks: Definition - Types – Deadlock detection, recovery, avoidance, prevention – Priority inversion – Solutions to priority inversion.

Text Books:

1. Phillips A.Laplante - "Real-Time Systems design and analysis", 3rd Edition, John Wiley & Sons, 2004.
2. Qing Li - "Real time Concepts for Embedded Systems ", CMP Books, 2003.
3. David E.Simon - "An Embedded Software Primer", Pearson Education, 2000.

Suggested Readings:

1. Chowdary Venkateswara Penumuchu – "Simple Real-time Operating System: A Kernel Inside View for a Beginner", Trafford publishing, 2007.
2. NPTEL Link 1 – http://www.youtube.com/watch?v=vo7LN-zMI2s
3. NPTEL Link 2 – http://www.youtube.com/watch?v=HlU5cYqGLZE

Learning Outcomes:

Unit – I	Students will be able to develop embedded systems employing RTOS based multitasking, various scheduling mechanisms and kernel objects
Unit – II	Students will have a clear knowledge to select the appropriate type of timer and memory management procedures for efficient usage memory in real time systems
Unit – III	The learner will be able to understand the way to categorize and incorporate various interrupts and exceptions to develop event driven real time systems. Further they can analyse its reflections on stack memory and execution time
Unit – IV	The learner will be able to rectify the issues related to resource allocation and procedure behind the design of real time system using RTOS

COURSE CODE : BECDEC605R01 / MCSDEC605R01
COURSE NAME : NEURAL NETWORKS AND FUZZY LOGIC
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the basics of artificial neural networks.
- To analyze the behavior of different ANN and its applications.
- To provide adequate knowledge about fuzzy set theory and help to understand the concept of fuzziness involved in various systems and their applications.

UNIT – I: Introduction to ANN and Perceptrons: 15 PERIODS

Introduction to Artificial Neural networks – Single Neuron Model – Biological Neuron and Artificial computing Neuron comparison – Introduction to learning in ANN with simple examples (Hebbian,delta rule) – Vector formulation – Single layered Perceptron-Realization of EXOR gate using ANN-Issues.
Need for Multilayered ANN-Back propagation network –Derivation – Generalized Delta rule – Update of output layer weights – Updates of hidden layer weights – Training data – Network sizing – Weights and learning parameters-Problems and Matlab programs

UNIT – II: Multilayered ANS Architectures: 15 PERIODS

Associative memory definitions – Bidirectional associative memory Networks – BAM energy function – Introduction to Recurrent networks- Discrete Hopfield network – Simple problems-Matlab programs.
Competitive networks –Hamming networks-Instar and Outstar Networks –Simple problems- Self organizing Kohonen networks-Adaptive resonance theory Concepts-Introduction to Learning Vector quantization(LVQ)-Examples and applications with Matlab demonstrations.

UNIT – III: Introduction to Fuzzy Sets: 15 PERIODS

Fuzzy sets – Fuzzy set operations – Properties of fuzzy sets –Fuzzy relations – Operations on fuzzy relations – Properties of fuzzy relations – Fuzzy Cartesian product and composition – Fuzzy tolerance and equivalence relations-Membership functions – Features of membership functions – Standard forms and boundaries – Fuzzification – Membership value assignment-Examples and Problems.

UNIT – IV: Fuzzy Operations and Logic: 15 PERIODS

Fuzzy to crisp conversions - λ cuts for fuzzy sets – λ cuts for fuzzy relations – Defuzzification methods.Extension principles – Functions of Fuzzy sets – Fuzzy transform (Mapping) – Practical considerations – Fuzzy numbers – Interval analysis in arithmetic – Approximate methods of extension – Vertex method – DSW algorithm-Simple problems-
Applications of Fuzzy logic-Introduction to Fuzzy control systems-Examples

Text Books:

1. Satish Kumar - "NEURAL NETWORKS : A Classroom Approach", McGraw Hill Inc., 2004.
2. Martin T.Hagan, Howard B.Demuth,Mark H.Beale - "Neural Network Design", PWS, 2002.
3. Timorthy J. Ross – "Fuzzy Logic with Engineering Applications" , McGraw Hill Inc., 2000.
4. Simon Haykin – " Neural Networks a comprehensive Foundation", Prentice Hall, 1999.

Suggested Readings:

1. J.A. Zurada – "Introduction to Artificial Neural Systems", Jaico Books, 2006.
2. Driankov – "Fuzzy Control", Narosa Publications, India, 2001.
3. NPTEL Link 1 – http://www.youtube.com/watch?v=cM1CF7gUm-U&list=PL964AE550C7B9C859&index=1
4. NPTEL Link 2 – http://www.youtube.com/watch?v=xbYgKoG4x2g

Learning Outcomes:

Unit – I	The learner will have an understanding of the basics of biological Neural Network, Feed Forward Neural Networks, Back Propagation Network and they will be able to write Matlab programs for BPN.
Unit – II	The learner will have an understanding of the basics of Hopfield Network, have understanding Self organizing Kohonen, Adaptive resonance theory and they will be able to write Matlab programs for BPN.
Unit – III	The students will have an understanding of the fuzzy set theory, fuzzy relations and fuzzy membership functions.
Unit – IV	The students will have an understanding of the fuzzy logic control and adaptive fuzzy logic, defuzzification, fuzzy arithmetic.

COURSE CODE : BECDEC606 / MCSDEC606
COURSE NAME : RADAR ENGINEERING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the principles and operations of RADAR and to acquire knowledge about the basic units of a radar system.
- To understand the basic concepts of radar tracking, processing of radar signals
- To learn various measurements and applications of RADAR

UNIT – I : Radar Fundamentals: 15 PERIODS

Principle of radar, CW and pulse types – Terminology regarding pulse – Radar range equations – Radar range – Range resolution beam width, dual wavelength radar – Doppler radar (concepts only) – Radar cross section of targets – Multiple trip echoer and anomalous propagation.

UNIT – II : Types of Radars: 15 PERIODS

CW radar, FM type and multiple frequency – MTI radar – Delay line cancellers – Range gate and filters – Pulse Doppler radars – Digital processing of radar signals – Tracking radars – Sequential lobbing, conical scanning and monopulse type – Tracking in range – Accuracy.

UNIT – III : Transmitters and Receivers: 15 PERIODS

Magnetron, linear, beam power tubes, TWT – Radar antenna, radome, radar receivers – Low noise RF amplifiers, Mixers, IF amplifiers display types – Duplexers.

UNIT – IV : Applications of Radar: 15 PERIODS

Uses of radar – Airborne radar – Doppler navigation – Remote sensing radars – Synthetic aperture Radars – MST radar systems – Meteorological applications of radar: cyclone warning and rainfall measurements – Doppler radar for tropospheric probing – Sea Surveillance - Over The Horizon (OTH) .
Electronic Counter Measures – Active and passive types – Conventional Electronic Counter-to-Counter Measures techniques.

Text Books:

1. Mark A. Richards - "Fundamentals of Radar Signal Processing", McGraw-Hill, 2005.
2. Merril.I Skolnik – "Introduction to Radar Systems", 3rd Edition, Tata McGraw Hill International, 2003.

Suggested Readings:

1. K. Sen and A.B. Bhatacharya – "Radar Systems and Radio Aids to Navigation", 6th Edition, Khanna Publications, 2006.
2. Bassem R. Mahafza – "Radar Systems Analysis and Design Using MATLAB", 2nd Edition, Taylor & Francis, 2005.

Learning Outcomes:

Unit – I	Students will be able to determine range, beam width and bearing.
Unit – II	Learners will have an understanding of how to track moving targets, how to design and simulate microwave radar systems.
Unit – III	Learners can design RF oscillators, amplifiers and various stages of RF receivers.
Unit – IV	Learner will have an understanding of suitable measurement methodologies to characterize and verify the performance of microwave radar systems and also on ECM techniques to safeguard from the hostile enemies.

COURSE CODE : BECCEC605R01 / MCSCEC605R01
COURSE NAME : MICROCONTROLLER LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To provide students complete hands on experience to develop embedded applications using AVR & ARM based microcontrollers and respective Integrated Development Environments (IDEs).

List of Experiments

Programs using ATmega8:

1. Program using Timers.
2. Pulse width measurement using External interrupt and ICU
3. PWM waveform generation using OCU
4. Application program using ADC and Analog comparator
5. Serial communication using USART and SPI
6. LCD and Matrix Keypad Interfacing

Programs using ARM7:

7. Application program using GPIOs
8. Application program using Timers
9. Application program using Interrupts
10. Application program using DAC
11. Application program using ADC
12. Application program using Real Time Clock (RTC)

Learning Outcomes:

Exp. No.	Outcomes
1.	The leaner will be able to generate precise time delays using various timer modules of ATmega8 microcontroller
2.	The leaner will be able to measure time intervals between external events using capturing module of ATmega8 microcontroller
3.	Students will be able to generate PWM waveforms using compare modules of ATmega8 and to control light intensity / motor speed
4.	Students can design circuits to read analog inputs from external devices and to feed on-chip ADC module of ATmega8 and in-turn make decisions based on the external signal level
5.	The leaner will be able to perform serial communications between devices employing USART & SPI modules of ATmega8 in both asynchronous and synchronous modes
6.	Students will be able to acquire data from matrix key pad and display the same in LCD module interfaced with ATmega8
7.	Students can interface I/O devices with slow and fast GPIOs of ARM7 - LPC2148
8.	The leaner will be able to generate precise time delays using timer module of ARM7 - LPC2148
9.	The leaner will be able to develop interrupt driven embedded systems using Vectored Interrupt Controller (VIC) module of ARM7 - LPC2148

10.	The leaner will be able to generate analog voltages equivalent based on digital inputs using DAC module of ARM7 - LPC2148
11.	The leaner will be able to perform analog to digital conversation using ADC module of ARM7 - LPC2148
12.	The leaner will be able to develop real time calendar and digital alarm clock using RTC module of ARM7 - LPC2148

COURSE CODE : BECCEC606R01 / MCSCEC606R01
COURSE NAME : MICROWAVE LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To understand the principle of operation of microwave sources and waveguides, to characterize the sources as well as various passive devices and to perform various measurements on the load side.

List of Experiments

1. Reflex Klystron-mode characteristics - Amplitude Modulation.
2. Reflex klystron-mode characteristics – Frequency Modulation
3. Gunn diode characteristics and PIN modulation.
4. Impedance measurement.
5. VSWR (low and high) measurements.
6. Characteristics of Isolator and Circulator
7. Horn antenna measurements – radiation pattern and gain.
8. Directional coupler – directivity and coupling coefficient.
9. E- Plane and H- plane characteristics.
10. Magic Tee characteristics.
11. Attenuator characteristics and power measurement.
12. Relation between free space wavelength and guide wavelength.

Learning Outcomes:

Expt. No	Outcome
1.	The learners will have an understanding of the mode characteristics of the reflex klystron oscillator operating in the X-band during amplitude modulation.
2.	The learners will have an understanding of the mode characteristics of the reflex klystron oscillator operating in the X-band during frequency modulation.
3.	The learners will have an understanding of the Gunn diode characteristics and PIN diode as the modulator.
4.	The learners will be able to measure the impedance of the given load.
5.	The learners will be able to measure both low- and high- voltage standing wave ratio.
6.	The learners can measure the insertion loss and isolation loss characteristics of the isolator and the circulator.
7.	The learners can plot the radiation pattern of the horn antenna and measure its gain.
8.	The learners will have an understanding of the directivity and coupling coefficient of the directional coupler.
9.	The learners will have an understanding of the characteristics of the E-plane Tee and the H-Plane Tee.
10.	The learners will study the characteristics of the Magic Tee.
11.	The learners will be able to perform the characteristics of variable attenuator.
12.	The learners will be able to obtain the relationship between free-space wavelength and guide-wavelength using slotted line section.

COURSE CODE : BECCTP 607 R02 / MCSCTP 607 R01
COURSE NAME : HR SKILLS-II
TOTAL PERIODS PER WEEK : 02
CREDITS : 02

Course Objective:

To make learners understand the employer expectations and help them to equip and face the job interviews successfully.

S.NO	TOPICS	NO. CLASSES
1	Employers Expectation	1
2	Selection Process	1
3	Resume Writing & Presentation	2
4	Aptitude Test	
	Verbal	1
	Logical	1
	Numerical	1
	Analytical	1
5	Getting ready for Interview	1
6	Technical Quiz (Core Subject)	3
7	Technical Interview (Core & Programming)	2
8	General Quiz	2
9	Quiz on Current Affairs	2
10	Debate on Current Affairs	2
11	Mock GD	3
12	Mock Interview	3
13	Semester Practical	3
14	Semester Theory Exam	1
TOTAL		**30**

Learning Outcomes:

Employer Expectations	The learner will get to know the expectations of employer from the prospective future employees
Selection Process	The learner becomes familiar with the selection process involved in the job interviews.
Resume Preparation	The learner learns the art of writing a successful resume.
Getting ready for an interview	The learner comes to know the ways to equip himself to face a job interview.
Mock GD	The learner understands the Do's and Don't's of a group discussion.
Mock Interview	The learner evaluates his personal preparedness for the future job interview.
Technical Quiz & Technical Interview	The learner will understand the importance of domain knowledge to face the technical round in job interview.
Aptitude Test	The learner understands the significance of Logical, verbal, analytical and numerical reasoning.
Quiz and Debate on current Affairs	The learner realizes the importance of General knowledge and knowledge on current affairs.

Scheme of Study and Syllabi for Semester VII of
B.Tech. Electronics & Communication Engineering Programme
(Common with)
M.Tech. Communication Systems (5 -Year Integrated) Programme

SEMESTER - VII

S. No.	Course Code	Course Name	Periods			Total Periods per week	Total No. of credits
			L	T	P		
01.	BECCEC 701R01/ MCSCEC 701R01	Information Theory and Coding	4	-	-	4	4
02.	BECCEC 702R01/ MCSCEC 702R01	VLSI Design	4	-	-	4	4
03.	BECCEC 703R01/ MCSCEC 703R01	Signal Processing Architectures and Algorithms	4	-	-	4	4
04.	BECCEC 704R01/ MCSCEC 704R01	Wireless Communication	4	-	-	4	4
05.		Department Elective VII	4	-	-	4	4
06.		Department Elective VIII	4	-	-	4	4
07.	BECCEC 705R01/ MCSCEC 705R01	HDL Programming Laboratory	0	-	3	3	2
08.	BECCEC 706R01/ MCSCEC 706R01	DSP Laboratory	0	-	3	3	2
		Total	24	-	6	30	28

List of Departmental Electives for VII Semester

BECDEC 701 R01 / MCSCDEC 701 R01 – Image Processing
BECDEC 702 R01 / MCSCDEC 702 R01 – Speech Processing
BECDEC 703 R01 / MCSCDEC 703 R01 – Computer Networks
BECDEC 704 R01 / MCSCDEC 704 R01 – Spread Spectrum Communication
BECDEC 705 R01 / MCSCDEC 705 R01 – Computer Communication
BECDEC 706 R01 / MCSCDEC 706 R01 – Telecommunication Switching, Traffic and Networks
BECDEC 707 R01 / MCSCDEC 707 R01 – Communication Protocols
BECDEC 708 R01 / MCSCDEC 708 R01 – Advanced Communication Networks
BECDEC 709 R01 / MCSCDEC 709 R01 – Embedded Systems
BECDEC 710 / MCSCDEC 710 – Radio Navigation Systems
BECDEC 711 / MCSDEC711 – Hardware Design with Bluespec System Verilog

COURSE CODE : BECCEC 701R01 / MCSCEC 701R01
COURSE NAME : INFORMATION THEORY AND CODING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the fundamental concepts of information theory and its significance to communication.
- To provide insight into the various types of communication channels and their respective capacities.
- To understand the nuances of source and channel coding techniques and their significance to efficient and reliable communication.

UNIT – I : Information Theory and Source Coding: 15 PERIODS

Block diagram of a communication system – Fundamental problems of communication – Information and entropy – Properties of entropy – Binary memoryless source – Extension to discrete memoryless source.
Elements of encoding – Properties of code – Kraft-Macmillan Inequality – Code length – Code Efficiency – Source Coding Theorem – Construction of optimal codes – Shannon-Fano encoding – Huffman's encoding and Lempel-Ziv Encoding.

UNIT – II : Noisy Channel Coding: 15 PERIODS

Measure of Information for two dimensional discrete finite probability scheme – marginal, conditional and joint entropies – Interpretation of different entropies for a two port communication system – Basic relationships among different entropies – Discrete memoryless channel – Mutual information – Properties – Channel capacity – Channel classification – Channel coding theorem.
Entropy in the continuous case – Definition and properties – Capacity of a band-limited Gaussian Channel – Hartley-Shannon's Law – Ideal system – Definition – Bandwidth efficiency diagram.

UNIT – III : Block codes, Cyclic codes and Convolutional codes: 15 PERIODS

Introduction – Hamming Code – linear block codes – syndrome decoding – minimum distance consideration – Cyclic codes: Generator polynomial – parity-check polynomial – encoder for cyclic codes – calculation of the syndrome – Convolutional Codes: Convolutional encoder representations – Principles of maximum-likelihood decoding of convolutional codes – Trellis Coded Modulation.

UNIT – IV : BCH, RS, LDPC and Turbo Codes: 15 PERIODS

General principles – Definition and Construction of Binary BCH codes – Error syndromes in finite fields – Decoding of SEC and DEC binary BCH codes – Error location polynomial – Peterson-Gorenstein-Zieler decoder – Reed-Solomon codes – Reed-Solomon encoding and Reed-Solomon decoding – LDPC Codes – Turbo codes.

Text Books:

1. Bernard Sklar and Prabitra Kumar Ray – "Digital Communications" 2nd Edition, Pearson Education, 2011.
2. Simon Haykin – "Communication Systems", 4th Edition, John Wiley and Sons, 2001.
3. F.M.Reza – "An introduction to information theory", McGraw Hill Inc., 1994.

Suggested Readings:

1. B.P.Lathi – "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2012.
2. Salvatore Gravano – "Introduction to Error Control Codes", Oxford University Press, 2011.
3. R.P.Singh and S.D.Sapre – "Communication Systems - Analog and Digital", 2nd Edition, Tata McGraw Hill, 2008.
4. Peter Sweeney – "Error Control Coding from Theory to Practice", 2nd Edition, Wiley, 2002.
5. NPTEL Link – http://www.youtube.com/watch?v=f8RvFlr5wRk

Learning Outcomes:

Unit – I	The learners will have an understanding of basic concepts of communication theory with an emphasis on entropy and source coding.
Unit – II	The learners will be able to understand the characteristics of the channel, its efficiency, capacity and the importance of shannon channel coding theorem.
Unit – III	The learners will be able to interpret various channel coding algorithms like Linear block codes , Cyclic codes ,Convolutional codes and Trellis coded modulation and their significance.
Unit – IV	The students will have an understanding of the construction of various channel coding approaches like BCH codes, Reed Solomon codes, Turbo codes, LDPC codes and their importance.

COURSE CODE : BECCEC 702R01 / MCSCEC 702R01
COURSE NAME : VLSI DESIGN
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the intricacies of VLSI Design & testing and to develop the knowledge of CMOS logic based circuit design issues.

UNIT – I : Introduction to MOS Circuits and MOS Logic Styles: 15 PERIODS

MOS transistor theory – Introduction to nMOS & pMOS Enhancement mode, Depletion mode transistors – Threshold voltage equation – Basic DC bias equation – Body effect– Second order effects – Sub-threshold region – Channel-length modulation – FN Tunneling – Drain Punch through – Hot Electrons effect – CMOS logic Circuits - MOS transistor switches – CMOS logic – Other forms of CMOS logic – Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic, Domino CMOS logic – Comparison between CMOS and Bipolar technologies – Circuit and System representations.

UNIT – II : IC Fabrication Technology and Scaling of MOS Circuits: 15 PERIODS

IC Fabrication Technology: CMOS Processing Technology – Fundamentals of Fabrication – Basic CMOS technology – P-well, N-well, Twin-tub and SOI – Gallium Arsenide technology.
Basic Circuit Concepts: Sheet resistance – Sheet resistance concept applied to MOS transistors and inverters – Area Capacitances of layers – Standard unit of capacitance – Delay unit –Inverter delays – Wiring capacitances.
Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters – Power-speed product, Limitations of scaling – Limits of miniaturization, Interconnect and contact resistance – Limits due to sub threshold currents – Limits on logic levels and supply voltage due to noise.

UNIT – III : Subsystem Design Processes and Design Rules: 15 PERIODS

Switch Logic : Pass transistors and transmission gates.
Stick diagrams and symbolic diagrams for nMOS, CMOS and BICMOS inverters, Parity generator, Multiplexer and Gray to binary code converter – Design rules and layout – Lambda based design rules – Contact Cuts – Double metal MOS process rules – CMOS lambda based design rules – General considerations of subsystem design processes – Illustration of design process – 4 bit Arithmetic processor arrangement.
Memories: Storage Elements – 3T and 1T dynamic RAM cells – 4T and 6T static CMOS memory cells – RAM arrays.

UNIT – IV: VLSI Testing Aspects: 15 PERIODS

Testing Combinational & Sequential Logic: Fault models in logic circuits – Stuck at Fault – Stuck on Fault – Bridging Faults - Fault Coverage – Fault Detection in Combinational logic circuits - I_{DDQ} testing - Test Generation Algorithms – One Dimensional Path sensitization – Boolean Difference - D Algorithm – Automatic Test Pattern Generation (ATPG).
DFT & Compression Techniques: Design for Testability – Observability and controllability – Ad-Hoc techniques – Scan based test techniques (LSSD, serial scan parallel scan) – Boundary Scan Techniques – JTAG – Built in Self Test (BIST) – Test Pattern generation for BIST – BILBO – Exhaustive Testing – Pseudo random pattern generation – Output Response Analysis – Transition-count – Syndrome checking – Signature Analysis.

Text Books:

1. Douglas A.Pucknell and Kamran Eshraghian – "Basic VLSI Design", 3rd Edition, PHI, 2011.
2. Neil H.E.Weste and Kamran Eshraghian – "Principles of CMOS VLSI Design",2nd Edition, Pearson Education Asia, 2010.
3. Parag K.Lala – "An Introduction to Logic circuit Testing", Synthesis Lectures on Digital Circuits and Systems, Morgan and Claypool publishers, 2008.

Suggested Readings:

1. Randall L.Geiger,Phillip E.Allen and Noel R.Strade – "VLSI Design Techniques for Analog and Digital Circuits", TATA McGraw Hill, 2010.
2. Robert .F.Pierret – "Semiconductor Device Fundamentals", Pearson Education, 2008.
3. Wayne Wolf – "Modern VLSI Design", 3rd Edition, Pearson Education, 2003.
4. Miron Abramovici, Melvin A.Breur and Arthur D.Friedman – "Digital Systems Testing and Testable Design", Jaico Publishing House, 2001.
5. Eugene D.Fabricius – "Introduction to VLSI Design", McGraw Hill, 1990.
6. NPTEL Link 1 – http://www.youtube.com/watch?v=Y8FvvzcocT4
7. NPTEL Link 2 – http://www.youtube.com/watch?v=9SnR3M3CIm4

Learning Outcomes:

Unit – I	Learners will be able to understand the various characteristics and effects of MOS transistors and to design circuits based on various CMOS logic forms.
Unit – II	Learners will have an understanding of various fabrication technologies of CMOS logic, circuit concepts and the issues related to scaling of MOS devices.
Unit – III	Learners will be able to understand the stick diagram representation of MOS circuits, design rules and to interpret the architecture of memory devices.
Unit – IV	Learners will have insight into the fault detection methodologies on and off the digital integrated circuits.

COURSE CODE : BECCEC 703R01 / MCSCEC 703R01
COURSE NAME : SIGNAL PROCESSING ARCHITECTURES AND ALGORITHMS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the architectures of various fixed and floating point digital signal processors.
- To understand the algorithm implementation flow on digital signal processors for various signal processing applications.

UNIT – I : General and Special Purpose Digital Signal Processors: 15 PERIODS

Introduction – General purpose digital signal processor – Fixed point – Floating point – Selecting a digital signal processor – Evolution of Signal Processing Architectures – Harvard architecture, pipelining – Multiplier Accumulator(MAC) – On chip memory cache – Special instructions – Replication – Extended parallelism techniques (SIMD,VLIW and Static Super Scalar processing) – Comparison of fixed point and floating point DSP processors.

UNIT – II : DSP Fixed Point Processor : 15 PERIODS

Architecture of TMS320C50 fixed point DSP processor – CALU – PLU – ARAU – Addressing modes – Program control (stack Pointer, Program counter, condition operation, repeat functions, Interrupts) – Memory space overview-Serial Port interface (serial port registers and operation only).

UNIT – III : DSP Floating Point Processor: 15 PERIODS

VLIW Architecture of TMS320C6713 floating point processor – Key features – functional overview – C6713 DSK functional diagram – basic operations – memory map – DSP Interfacing CODEC (AIC23) – Code Composer Studio – Key features of CCS – Debugging using CCS.

UNIT – IV : Implementation of DSP Algorithms on Digital Signal Processors and Applications: 15 PERIODS

FIR filtering – IIR filtering (Direct Form I, Direct Form II, Cascade and Parallel Forms) – FFT implementation – Wiener filtering – LMS adaptive algorithm – Recursive Least Square algorithm – Factorization algorithm – Discrete Kalman Filtering Algorithm.
Applications – Adaptive filtering of Ocular Artifacts from the human EEG – Real time implementation – Noise Cancellation – Channel Equalization.

Text Book:

1. Emmanuel C. Ifeachor and Barrie W. Jervis – "Digital Signal Processing: A Practical Approach ", 2nd Edition, Pearson Education, 2012.

Data sheets and Web sites:

1. TMS320C5X – User manual, Texas Instruments.
2. TMS320C67XX – User manual, Texas Instruments.

Suggested Readings:

1. B.Venkataramani and M.Bhaskar – "Digital Signal Processors - Architecture , Programming and Applications", 2nd Edition, TMH, 2011.
2. Simon Haykin – "Adaptive filter theory", 4th Edition, Pearson Education, 2009.

3. John G.Proakis, Dimitris G. Manolakis – "Digital Signal Processing Principles, Algorithms and Applications", 4th Edition, Pearson Education India, 2007.
4. NPTEL Link – http://www.youtube.com/watch?v=SKuywStjBLY

Learning Outcomes:

Unit – I	Learners will be able to understand the fundamental concepts of application-specific instruction-set processors (ASIP)
Unit – II	Students will have an understanding of the intricacies of the architecture and instruction set of fixed point digital signal processors.
Unit – III	Students will have an understanding of the intricacies of the architecture and instruction set of floating point digital signal processors with an emphasis on Code Composer Studio.
Unit - IV	Learners will be able to implement various adaptive algorithms addressing the different real time applications on digital signal processors.

COURSE CODE : BECCEC 704R01 / MCSCEC 704R01
COURSE NAME : WIRELESS COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the concepts of cellular system and methods to improve its capacity and coverage.
- To get insight into the methods of improving the performance of wireless communication systems.
- To comprehend the various existing wireless standards.

UNIT – I : Introduction to wireless communication : 14 PERIODS

Examples of wireless communication systems – Introduction to cellular concept – frequency reuse – Channel assignment strategies – Handoff strategies – System generated interference – Trunking efficiency and grade of service – improving capacity and coverage in cellular system –sectoring – channel sharing and borrowing – Microcell systems

UNIT – II : Mobile Radio Propagation: 16 PERIODS

Free space propagation model – reflection – diffraction – scattering – link budget design –Outdoor Propagation models – Indoor propagation models – Small scale Multipath propagation – Impulse response model – Small scale Multipath measurements – parameters of Mobile multipath channels – types of small scale fading – statistical models for multipath fading channels.

UNIT – III : Equalization and Diversity: 15 PERIODS

Fundamentals of Equalization – Linear and Non-linear Equalization techniques – Diversity schemes – microscopic, macroscopic, polarization, frequency Diversity – OFDM, Choice of OFDM modulation – OFDM system performance over AWGN channels – Applications of OFDM – CDMA – MC-CDMA – time diversity and spatial diversity**:** MIMO Systems – combining schemes.

UNIT – IV : Wireless Standards: 15 PERIODS

Advanced Mobile Phone System (AMPS) – United States Digital Cellular(USDC) – Global System for mobile (GSM) – GPRS – IS-95 – Cordless Telephone – 2(CT2) Standard for cordless telephone – Digital European Cordless Telephone (DECT) – Personal Access Communication System (PACS) – Wireless in Local Loop (WLL) – Blue tooth – Zigbee – Mobile Broadband: Introduction to LTE and Wi-MAX – Cognitive Radio.

Text Book:

1. T.S.Rappaport – "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2012.

Suggested Readings:

1. Alexander M.Wyglinski, MaziarNekovee and Thomas Hou – "Cognitive radio communications and networks-principles and practice",Academic press-Elsevier,2010.
2. Du, Ke-Lin; Swamy, M. N. S – "Wireless Communication Systems - From RF Subsystems to 4G Enabling Technologies", Cambridge University Press, 2010.
3. Stephen G. Wilson – "Digital Modulation and Coding", Pearson Education, 2008.

4. W.C.Y.Lee – "Mobile Communications Engineering: Theory and applications", 2nd Edition, TMH, 2008.
5. R. Blake – "Wireless Communication Technology", Thomson/Delmar, 2004.
6. Van Nee Richard and Prasad Ramjee – "OFDM for wireless Multimedia communication", Artech House, 2000.
7. K. Feher – "Wireless Digital Communications - Modulation and Spread Spectrum Applications", Prentice-Hall PTR, 1995.
8. NPTEL Link – http://freevideolectures.com/Course/2329/Wireless-Communication

Learning Outcomes:

Unit – I	The learners will be able to understand the terminologies, concepts of cellular system and its working model.
Unit – II	The learners will have an understanding of the various mobile radio propagation models and their influence on the performance of the cellular system.
Unit – III	The learners will get insight into the concepts of improving the cellular system performance by adopting equalization and diversity. The learners will also acquire knowledge on Orthogonal frequency division multiplexing (OFDM) systems, code division multiple access (CDMA) systems and Multicarrier CDMA.
Unit – IV	The students will be able to acquire knowledge on existing wireless standards, LTE , WiMax, cognitive radio and Personal Area Networks (PAN).

COURSE CODE : BECCEC 705R01 / MCSCEC 705R01
COURSE NAME : HDL PROGRAMMING LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

- To understand the VHDL and Bluespec System Verilog programming concepts
- To implement various simple and complex logic designs in FPGA using Quartus II and Xilinx ISE platforms
- To train students to design a process and test the same to meet the hardware industrial demands.

List of Experiments

I. Programs using VHDL (With suitable Behavioral, Data flow, and Structural descriptions)

1. Adders & Subtractors
2. Multiplexers & Demultiplexers
3. Decoders & Encoders
4. Comparators
5. Multipliers
6. Latches & Flip-Flops
7. Shift Registers
8. Counters

II. FPGA Implementation using Quartus II IDE (With Cyclone II FPGA)

9. Combinational and sequential circuits
10. RTC using onboard peripherals

III. Programs using Bluespec System Verilog

11. Combinational and sequential circuits
12. Finite State machine modeling

Learning Outcomes:

Expt. No	Outcome
1.	The learners will be able to differentiate and simulate the various types of Adders & Subtractors using dataflow, behavioral and structural models of VHDL code.
2.	The learners will be able to design and simulate the different types of Multiplexers and Demultiplexers using dataflow, behavioral and structural models of VHDL code.
3.	The learners will be able to design and simulate the different types of Encoders and Decoders using dataflow, behavioral and structural models of VHDL code.
4.	The learners will be able to design and simulate the comparators using dataflow, behavioral and structural models of VHDL code.

5.	The learners will be able to design and simulate the various multiplier architectures using dataflow, behavioral and structural models of VHDL code.
6.	The learners will be able to understand and simulate the Latches and various Flip-Flops using behavioral and structural models of VHDL code.
7.	The learners will be able to design and simulate the different types of shift registers using behavioral and structural models of VHDL code.
8.	The learners will be able to design and simulate the different types of counters using behavioral and structural models of VHDL code.
9.	The learners will be able to understand the concept of synthesis and implement the earlier simulated combinational as well as sequential circuits on Cyclone II FPGA using Quartus II IDE.
10.	The learners will be able to implement the Real Time Clock on Cyclone II FPGA with peripherals using Quartus II IDE.
11.	The learners will be able to simulate the various combinational and sequential circuits using Bluespec System Verilog workstation.
12.	The learners will be able to model and simulate the mealy and moore state machines using Bluespec System Verilog workstation.

Additional Experiments:

IV. Implementation using Xilinx ISE & Eclipse IDE:

1. Seven Segment Display Interfacing using APIs
2. GPIO Interfacing

Learning Outcomes:

Expt. No	Outcome
1.	The learners will be able to work in Xilinx ISE and Eclipse IDE platforms. The learners will also be able to implement the seven segment display interfacing on both FPGA as well as OMAP Processor platforms.
2.	The learners will be able to implement GPIO interfacing on both FPGA as well as OMAP Processor platforms.

COURSE CODE : BECCEC 706R01 / MCSCEC 706R01
COURSE NAME : DSP LABORATORY
TOTAL PERIODS PER WEEK : 03
CREDITS : 02

Course Objective:

To implement the various signal processing algorithms on tools such as MATLAB, Fixed Point DSP Processor and Floating Point DSP Processor.

List of Experiments

I. Experiments using MATLAB

1. Decimation and Interpolation by Integer factors
2. Power Spectrum Estimation using Yule Walker method and Burg method
3. Hamming Code generation and Error correction
4. Discrete Cosine Transform and Discrete Wavelet Transform (Harr Wavelet) for a given image
5. Histogram Equalization for a given signal and image

II. Experiments using Fixed Point Digital Signal Processor

6. Familiarizing instructions related to different addressing modes and MAC operations
7. Array to Array data transfer using memory operation instructions
8. Linear Convolution and Circular Convolution of given sequences
9. Generation of Waveforms (Square, Triangle, Ramp)

III. Experiments using Floating Point Digital Signal Processor

10. Familiarizing instructions related to different addressing modes
11. Design of FIR filters
12. FFT Implementation (Radix 2 DIT FFT Algorithm).

Learning outcomes:

Expt. No	Outcome
1.	The learners will be able to simulate and analyze the Decimation and Interpolation concepts by an integer factor D and I using MATLAB code.
2.	The learners will be able to model and simulate the parametric methods of estimating the Power Spectral Density using Yule Walker method and Burg methods by using MATLAB code.
3.	The learners will be able to simulate Hamming Code generation and Error correction using MATLAB code.
4.	The learners will be able to differentiate the image enhancement and image compression techniques using Discrete Cosine Transform and Discrete Haar Wavelet transform techniques and simulate them for the given image using MATLAB code.

5.	The learners will be able to understand and simulate the Histogram Equalization of the given signal and image to identify the number of occurrences of gray levels present in the image using MATLAB code.
6.	The learners will be able to understand the concepts of various addressing modes and to familiarize with the assembly language program to perform various operations including Multiply and Accumulate using a Fixed Point DSP processor.
7.	The learners will be able to perform data transfer between memory locations by means of assembly language program with Fixed Point DSP processor instructions.
8.	The learners will be able to understand the implementation aspects of linear and circular convolution of given sequences on the Fixed Point DSP processor.
9.	The learners will be able to generate square, ramp, triangular waveforms using Fixed Point DSP processor.
10.	The learners will be able to understand the instructions related to various addressing modes of Floating Point DSP processor
11.	The learners will be able to design of Finite Impulse Response filters such as LPF, HPF using Floating Point DSP processor.
12.	The learners will be able to understand the concepts of FFT algorithms namely DIT and DIF to minimize the number of complex multiplications and complex additions and implement them using Fixed Point DSP processor.

COURSE CODE : BECDEC 701R01 / MCSDEC701R01
COURSE NAME : IMAGE PROCESSING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course objective:

- To provide strong theoretical foundation for digital image processing techniques.
- To analyze a wide variety of image processing techniques for digital image enhancement.

UNIT – I : Digital Image Fundamentals and Image Transforms: 15 PERIODS

Digital Image Fundamentals: Elements of Digital Image Processing Systems – Elements of Visual Perception – Image Model – Sampling and Quantization – Basic Relationship Between Pixels – Colour Image Fundamentals and Models.
Image transforms: DFT – Properties of the Two-Dimensional Fourier Transform – Separable Transforms: Hadamard Transform – Discrete Cosine Transform – Haar Transform – Discrete wavelet Transforms.

UNIT – II : Image Enhancement and Image Restoration: 16 PERIODS

Image Enhancement: Point Processing – Intensity Transformations, Histogram Processing, Image Subtraction and Image Averaging – Spatial Filtering – Frequency Domain Filtering – Lowpass, Highpass, Highboost and Homomorphic Filtering.
Image Restoration: Degradation Model – Algebraic Approach to Restoration - Unconstrained Restoration and Constrained Restoration – Inverse Filtering – Formulation and Removal of Blur Caused by Uniform Linear Motion – Least Mean Square (Wiener) Filter.

UNIT – III : Image Segmentation and Morphological Image Processing: 14 PERIODS

Image Segmentation: Detection of Discontinuities – Point Detection, Line Detection and Edge Detection – Edge Linking and Boundary Detection – Local Processing and Global Processing via the Hough Transform – Thresholding – Region-Oriented Segmentation – Use of Motion in Segmentation.
Morphological Image Processing: Dilation and Erosion – Opening and Closing – Hit-or-Miss Transform – Basic Morphological Algorithms.

UNIT – IV : Image Compression: 15 PERIODS

Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy and Fidelity Criteria – Image Compression Models – Error-Free Compression – Lossy Compression – Lossy Predictive Coding and Transform Coding – Image Compression Standards – Bilevel Image Compression Standards and Continuous Tone Image Compression Standards –Introduction to Fractal image compression.

Text Book:

1. Gonzalez and Woods – "Digital Image Processing", 3rd Edition, Pearson Education, 2012.

Suggested Readings:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle – "Image Processing, Analysis and Machine Vision", 3rd Edition, Brroks Cole, 2008.
2. Anil K.Jain – "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3. Jae S.Lim – "Two-Dimensional Signal and Image Processing", Prentice Hall, 1990.

4. NPTEL Link – http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur.

Learning Outcomes:

Unit – I	Learners will have understanding of digital image representation on spatial and transform domains.
Unit – II	Learners will be able to comprehend the image enhancement operations and various techniques for image restoration.
Unit – III	Learners will be able to get insight into the concepts of image segmentation and morphological image processing for different applications.
Unit – IV	Learners will be able to understand the techniques employed for image compression.

COURSE CODE : BECDEC 702R01 / MCSDEC 702R01
COURSE NAME : SPEECH PROCESSING
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To understand the process of speech production and to analyse speech signal using various time and frequency domain techniques.

UNIT– I : Nature of Speech Signal: 15 PERIODS

Speech production mechanism – Classification of speech – sounds – nature of speech signal – models of speech production.
Speech signal processing: purpose of speech processing – digital models for speech signal – Digital processing of speech signals – Significance – short time analysis.

UNIT– II : Time Domain Methods for Speech Processing: 15 PERIODS

Time domain parameters of speech – methods for extracting the parameters – Zero crossings – Auto correlation function and pitch estimation.

UNIT– III : Frequency Domain Methods for Speech Processing: 15 PERIODS

Short time Fourier analysis – filter bank analysis – spectrographic analysis – Format extraction – pitch extraction – Analysis – synthesis systems.

UNIT– IV : Speech Coding and Speech Analysis: 15 PERIODS

Formulation of linear prediction problem in time domain – solution of normal equations – Interpretation of linear prediction in auto correlation and spectral domains – Applications of speech processing – Speech recognition – Speech synthesis and speaker verification.

Text Book:

1. L.R. Rabiner, R.E Schafer and Ronald W – "Digital processing of speech signals", Pearson Education, 2011.

Suggested Readings:

1. I.H.Witten – "Principles of Computer Speech", Academic press, 1982.
2. J.L Flanagan – "Speech Analysis Synthesis and Perception", 2nd Edition, Springer- Verlag, 1972.
3. NPTEL Link 1 – http://www.youtube.com/watch?v=aeOLjFe256E &list= PLD392E2AC AE F0C689&index=2
4. NPTEL Link 2 – http://www.youtube.com/watch?v=MBxFVBAzdMc

Learning Outcomes:

Unit – I	The learner will have an understanding of various speech production system parameters
Unit – II	The learner will be able to apply the various time domain algorithms for extracting the speech features.
Unit – III	The learner will be able to apply the various frequency domain algorithms for extracting the speech features.
Unit – IV	The learner will have an understanding of the principles in speech coding and will be able to develop a speaker verification system.

COURSE CODE : BECDEC 703R01 / MCSDEC 703R01
COURSE NAME : COMPUTER NETWORKS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course objective:

- To understand the OSI layer concepts and functionalities of each layer in computer networks.
- To analyze the various routing algorithms for Internet as well Intranet.
- To understand the mulltiple applications of computer networks.

UNIT – I : Introduction to Computer Networks and Internet : 17 PERIODS

Internet – Network edge – Network core – Network security – Network access and physical media – Internet Service Providers (ISPs) and Internet back bones – packet switched networks – Delay and loss – Types of delay, Queuing delay and Packet loss – Protocol layers and their service models – Layered Architecture – Protocol Stack Network Entities and Layers.

UNIT – II : Transport Layer: 15 PERIODS

Transport layer services – Multiplexing and demultiplexing – Connectionless transport – User Datagram Protocol (UDP) – UDP Segment Structure – UDP check sum – principle of Reliable data transfer – Go-Back-N(GBN) – Selective Repeat(SR) – Connection oriented transport –TCP – Congestion control.

UNIT – III : Network Layer and Routing: 14 PERIODS

Network service models – Routing principles – Hierarchical Routing – Internet protocol (IP) – IPV4 addressing – IP Datagram format, fragmentation – Routing in the Internet – Input ports, switching fabric, output ports of a router – IPV6 – Multicast routing – Internet Group Management Protocol (IGMP) – Mobility and the network layer – Mobile IP.

UNIT – IV : Link Layer and LAN: 14 PERIODS

Link Layer services – Error detection and correction techniques – CRC – Multiple access protocols – LAN addresses and Address Resolution Protocol (ARP) – Ethernet – Carrier Sense Multiple Access with Collision Detection (CSMA/CD) – Hubs – Bridges – Switches – Wireless LAN : IEEE 802.11b – Blue tooth – Point-to-point protocol – Asynchronous Transfer Mode (ATM) – Frame relay.

Text Book:

1. James. F. Kurose and Keith. W. Ross – "Computer Networking: A Top-Down Approach" , 6th Edition, Pearson Education, 2012.

Suggested Readings :

1. W. Stallings – "Data and Computer Communications", 10th Edition, Prentice Hall, 2013.
2. William Stallings – "High Speed Networks and Internet", 2nd Edition, Pearson Education, 2010.
3. S. Keshav – "An Engineering Approach to Computer Networking", Pearson Education, 2008.
4. Andrew S. Tanenbaum – "Computer Networks", 4th Edition, Prentice Hall Professional, 2003.
5. NPTEL Link – http://freevideolectures.com/Course/2276/Computer-Networks

Learning outcomes:

Unit – I	The learners will be able to understand the fundamentals of networks and their layered architecture.
Unit – II	The learners will have an understanding of concepts related to transport layer services.
Unit – III	The learner will understand functions of network layer and different routing protocols.
Unit – IV	The learners will be able to get insight into various LAN topologies , inter and intra networking components , their significance and applications.

COURSE CODE : BECDEC 704R01/ MCSDEC 704R01
COURSE NAME : SPREAD SPECTRUM COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To provide knowledge on spread spectrum communication fundamentals and it's applications to mobile communications.
- To expose the learners to the recent advances in the context of next generation cellular system designs based on CDMA.

UNIT – I : Introduction to Spread Spectrum: 15 PERIODS

Spread spectrum principles – Purpose – Basic spreading sequences – PN Sequences – Maximum Length linear Shift Register Sequences – randomness properties, Gold codes, Kasami Sequences. Orthogonal codes – Walsh codes, orthogonal gold codes. Introduction to CDMA – DS-CDMA transmission model – Receiver Model – Processing gain – jamming Margin – Recovery of the information signal – Recovery of the information signal in Multiple access Interference (MAI).

UNIT – II : Multiuser Detection: 15 PERIODS

Optimum Detector for synchronous channels – Two user, K user - Optimum Detector for Asynchronous channels – Two user, K user – Minimum error probability in synchronous and Asynchronous channels – Performance analysis in Rayleigh fading channel – optimum non coherent multi user Detection.

UNIT – III : CDMA Systems: 15 PERIODS

UTRA- characteristics – transport and physical channels – service multiplexing and channel coding- Spreading and Modulation – Random access – power control – CDMA 2000 – terrestrial radio access – Characteristics – physical channels – service multiplexing and channel coding – spreading and modulation – random access – Hand over.

UNIT – IV : MC- CDMA Systems: 15 PERIODS

Overview of MC- CDMA systems – Performance of MC-CDMA systems – Transmitter – Receiver – Noise and interference analysis – Decision statistics and error probability – MC-CDMA performance in synchronous environment – Frequency selective channel model – System model – Single user detection – Multi user detection

Text Books:

1. Lie-Liang Yang – "Multicarrier Communications", John Wiley & Sons, 2009.
2. L. Hanzo, M. Münster, B.J. Choi and T. Keller – "OFDM and MC-CDMA for broadcasting Multi - user Communications, WLANs and Broadcasting", Wiley publishers, IEEE Press, 2005.
3. Sergio verdu – "Multiuser Detection", Cambridge University press, 2003.

Suggested Readings:

1. L. Hanzo, L-L. Yang, E-L. Kuan and K. Yen – "Single and Multi-Carrier DS-CDMA – Multiuser Detection, Space-Time Spreading, Synchronization and Standards", John Wiley & Sons, IEEE Press, 2003.
2. J. S. Lee and L. E. Miller – "CDMA Systems Engineering Handbook", Artech House, 1998.
3. J. Viterbi – "CDMA Principles of Spread Spectrum Communication", Addison- Wesley, 1995.
4. R. C. Dixon – "Spread Spectrum Systems with Commercial Applications", 3rd Edition, John Wiley & Sons, 1994.

5. NPTEL Link – http://www.youtube.com/watch?v=TJNKoRPn-G8

Learning Outcomes:

Unit – I	The learners will be able to understand the concepts of spread spectrum design codes and to analyze their performance.
Unit – II	The learners will be able to understand standard narrowband communication systems and spread spectrum systems. The learners will also be able to analyze the performance of spread spectrum systems in the presence of interference.
Unit – III	The learners will be able to analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context). They will also have an understanding of spreading code acquisition and tracking circuits.
Unit – IV	The learners will be able to analyze the performance of multiple access techniques based on spread spectrum (i.e., CDMA).

COURSE CODE : BECDEC 705R01 / MCSDEC 705R01
COURSE NAME : COMPUTER COMMUNICATION
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To provide in depth knowledge about different modes of data communication.
- To understand the different components to build computer networks.
- To have familiarity with the basic routing protocols and security mechanisms of computer networks and how they can be used to assist in network design and implementation.

UNIT – I : Introduction to Data Communication: 14 PERIODS

Data transfer modes – Parallel I/O – Serial I/O – Synchronous communication – Asynchronous communication – Speed-matching.
The telephone system – Multiplexers – concentrators and front-end processors – Circuit switching – Message switching – Packet switching – Computer-to-Terminal handling.

UNIT – II : Computer Networks: 14 PERIODS

Evolution of data networks – Network Architecture – The ISO reference Model – Examples of networks: ARPANET, NSFNET – Applications of networks.

UNIT – III : Point – to – Point Networks: 15 PERIODS

Virtual circuits and Datagrams – Routing algorithms and congestion – Examples and Network layer – Local Area Network (LAN) – Wide Area Network (WAN)

UNIT – IV : Network Security: 17 PERIODS

Cryptography – One-Time Pads – Quantum Cryptography – Symmetric key cryptography – Traditional ciphers – Block ciphers – Operation modes – DES – AES – Public key cryptography – RSA – Message Security – Privacy, Message authentication, integrity and Non repudiation – Digital Signature – User Authentication Key management – Kerberos

Text Book:

1. Behrouz A Forouzan – "Data Communications and Networking", 5th Edition, Tata McGraw Hill Education, 2012.

Suggested Readings :

1. S. Tanenbaum – "Computer Networks", 4th Edition, Pearson Education, 2011.
2. William Stallings – "Data and Computer Communication", 8th Edition, Pearson Education, 2009.
3. James. F. Kurose and Keith. W. Ross – "Computer Networking: A Top-Down Approach", 6th Edition, Pearson Education, 2012.
4. NPTEL Link 1 – http://www.youtube.com/watch?v=sG6WGvzmVaw&index= 2&list= PL8BF 3052396E05930
5. NPTEL Link 2 – http://www.youtube.com/watch?v=dxslf8jHlAo&index=3&list= PL8BF 3052396E05930

Learning Outcomes:

Unit – I	The students will be able to understand the basics of data transfer modes and types of communication. They will also understand switching concepts with preferable switching for computer networks.
Unit – II	The learners will be able to understand the role of layered architecture in computer networks. Students will have an idea about ARPANET and NSFNET with their applications.
Unit – III	The learners will be able to understand functions of network layer and different routing protocols. They will also be able to analyze the congestion control algorithms.
Unit – IV	The learners will be able to understand the concepts of network security and various related algorithms.

COURSE CODE : BECDEC 706R01 / MCSDEC 706R01
COURSE NAME : TELECOMMUNICATION SWITCHING, TRAFFIC AND NETWORKS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective :

- To understand the need for switching systems and their evolution from analog to digital and the concepts of Public Switched Telephone Network and ISDN.
- To comprehend the different types of existing signaling methods, analog and digital switches, analog and digital networks and cellular networks.
- To acquire knowledge about routing plan and network management.
- To compute traffic parameters, blocking probability, loss and delay in the system.
- To design traffic without congestion and to design multistage networks.

UNIT – I : Introduction to Switching Systems: 15 PERIODS

Introduction to switching system – circuit, message and packet switching – switching system function – classification – switching centre model – Telephone system – telephone instruments – rotary dial, push button, cordless telephones, caller ID, electronic (Key) telephones, Paging system.
Signals in telephone system – subscriber loop – Basic telephone call procedures, call progress tones and signals – Voice frequency circuit arrangements – SLIC (Subscriber Line Interface Circuit) Transmission Bridges – Two wire – four wire circuits Hybrids, Echo suppresser, Echo cancellers, cross talks.
Control of switching system – common control, distributed control, time shared decision making control – stored program control – computer controlled switching system.

UNIT – II : Telecommunication Traffic and Signaling: 15 PERIODS

Introduction to traffic – Traffic characterization, Parameters, Traffic unit – Congestion – Arrival distribution – Holding time distribution – Erlang and Engest equations – Grade of service – Blocking probability – Models for switching system – Loss system, delay system.
Introduction to signaling – Signals for telephone system – Control signal functions – Signaling tones – Customer line signaling – Audio frequency junctor and trunk circuits – FDM carrier system – Out band signaling, In band signaling – PCM signaling – Inter register signaling – Common channel signaling (CCS) – CCS network – CCITT signaling systems number 6 and 7 – High level data link protocol – Signal units – The signaling information field – Digital customer line signaling.

UNIT – III : Switching Network: 15 PERIODS

Switching functions – Space division switches – Relay, reed relay, uniselector, two-motion selector, cross bar switches and electronic space division switches – Analog and Digital Time division switching– Time slot interchange (TSI) – Modes of operation – Space array for digital switches – Combined space and time switching.
Single stage network – Grading – Multistage network – Non blocking switch – Blocking probability – Lee's graph – Switch matrix control.

UNIT – IV : Telecommunication Networks: 15 PERIODS

Telecommunication network – Analog network – Hierarchical network – Integrated Digital Network (IDN) – ISDN – Objectives, benefits, user interface – Services supported by ISDN – ISDN protocol architecture – Internetworking between ISDN and other networks – Cellular radio network –

Intelligent network – Private network – Numbering plans – National, International, ISDN and PDN – Charging plan – Routing plan – Network management – Over load, routing and flow controls.

Text Books:

1. Wayne Tomasi – "Introduction to Data communications", Pearson Education, 2011.
2. J.E. Flood – "Telecommunication switching, Traffic and Networks", Pearson Education, 2007.
3. Thiyagarajan Viswanathan – "Telecommunication Switching System and Networks", PHI, 2006.

Suggested Readings:

1. Roddy R Coolen – "Electronic Communication", Pearson Education",4th Edition, 2009.
2. James Martin – "Telecommunication and the Computer", PHI, 1998.
3. NPTEL Link – http://www.youtube.com/watch?v=xdUjwlyyi9U

Learning outcomes:

Unit – I	Learners will be able to understand the principles of Switching Systems and Public Switched Telephone Network in the field of Telecommunication systems.
Unit – II	Learners will have an understanding of traffic prediction and design the traffic without congestion.
Unit – III	Learners will be able to understand the principles and design analog and digital switches and multistage networks.
Unit – IV	Learners will be able to understand the analog & digital networks, cellular networks, charging and routing plan and network management systems.

COURSE CODE : BECDEC 707R01 / MCSDEC 707R01
COURSE NAME : COMMUNICATION PROTOCOLS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To provide in depth knowledge about the basics of communication protocols.
- To understand the layering concepts and functionalities of each layer in computer networks.
- To have familiarity with the protocol related to WAN, Internet, VoIP and WAP model and protocol architecture.

UNIT – I : Basic Concepts and OSI model: 12 PERIODS

Line configuration – Topology – Data Transmission mode – parallel and serial – synchronous and asynchronous. Data communication hardware and equipment – Definition – Protocol-Need for Communication Protocols – Basic requirements of communication protocol – Data link protocols. Need for Protocol standards – Open System Interconnection (OSI) – OSI layer functions.

UNIT – II : WAN Protocols: 15 PERIODS

ISDN Architecture – ISDN protocol layers – B-ISDN – X.25 Layers – physical layers – Frame layers – packet layers – PLP layers – Frame Relay – Operation – Frame relay layers – Congestion Control – Congestion Avoidance – Discarding – Leaky bucket algorithm – Traffic Control – Flow Control – Stop and wait – sliding window – error control – automatic repeat request (ARQ) – ATM – ATM protocol layers

UNIT – III : Transmission Control Protocols / Internet Protocols(TCP/IP): 18 PERIODS

Introduction – TCP / IP Features – IP addresses – Logical addresses – Address Resolution Protocol (ARP) – Reverse Address Resolution Protocol (RARP) – Internet Control Message Protocol (ICMP) – datagram fragmentation and reassembly – Ports and Sockets – TCP connections – Packet format – UDP – UDP packet – Domain Name server (DNS) and E-Mail – File Transfer Protocol (FTP) – Trivial File Transfer Protocol (TFTP) – Simple Mail Transfer Protocol. World Wide web (WWW) – Hyper Text Transfer protocol (HTTP) – Post office Protocol (POP3) – Terminal network (TELNET)

UNIT – IV : Wireless Protocol and VoIP: 15 PERIODS

Wireless networks – Restrictions – WLAN Architecture – Physical and MAC layers – Wireless Application Protocol (WAP) model – WAP Protocol Architecture – Overview of Voice over internet protocol (VoIP).

Text Books:

1. Behrouz A Forouzan – "Data Communication and Networking", 2nd Edition, Tata McGraw Hill, 2013.
2. Achyut S Godbole – "Data Communications and Networks", Tata McGraw Hill, 2005.

Suggested Readings:

1. James F. Kurose – "Computer Networking: A Top-Down Approach", Pearson Education, 2012.
2. Pahlaven K, Prashanth Krishnamurthy – "Principles of Wireless Networks: a unified approach", PHI, 2011.
3. William Stallings – "Data and Computer Communication", 9th Edition, Pearson Education, 2011.
4. Wayne Tomasi – "Introduction to Data communications and Networking", Pearson Education 2011.

5. Dale Bulbrook – "WAP: A Beginner's Guide", McGraw-Hill, 2001.
6. NPTEL Link 1 – http://www.youtube.com/watch?v=601x64peZtU
7. NPTEL Link 2 – http://www.youtube.com/watch?v=pVl1L1jrbFE

Learning outcomes:

Unit – I	The learners will be able to know about the basics of networks and basics of data transfer modes and types of communication protocol.
Unit – II	The learner will have an understanding of functions of WAN. They will be analyzing congestion control algorithms , Frame Relay and ATM networks.
Unit – III	The learners will be able to know the services from transport layer and network layer. Students will also be able to enumerate IP address and physical address with their conversion protocols.
Unit – IV	The Students will be able to understand the WLAN architecture and intricacies of VoIP.

COURSE CODE : BECDEC 708R01 / MCSDEC 708R01
COURSE NAME : ADVANCED COMMUNICATION NETWORKS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the concepts of B-ISDN, Frame Relay and ATM networks.
- To get insight into the protocol structure of wireless LAN and PAN.
- To analyze various routing algorithms for Ad hoc networks.

UNIT – I : Broad Band Networks: 15 PERIODS

Introduction to Broadband Networks – Packet Switching Networks, Frame Relay Networks – Network Evolution through IDN to B-ISDN – ATM, ATM Protocol Architecture, ATM Cells, ATM service Categories, AAL, Wireless ATM.

UNIT – II : Wireless LAN and PAN: 15 PERIODS

Wireless LAN – Wi-Fi, Wi-Max – Mobile IP – Blue tooth Over all architecture , Protocol Stack, Physical Connection, MAC Mechanism, Connection Management, Security – Zigbee, Protocol Architecture, Physical layer, MAC Layer, Zigbee Layer, Applications.

UNIT – III : Ad hoc Networks: 15 PERIODS

Introduction of Ad hoc networks – applications, Issues in Ad Hoc Wireless Networks – Routing protocols Classification, Destination Sequenced Distance Vector routing (DSDV), Dynamic Source Routing (DSR),Ad hoc On-demand Distance Vector routing (AODV), Zone Routing Protocol (ZRP),Optimized link state routing protocol (OLSR), Ad-hoc On-demand Multipath Distance Vector(AOMDV).

UNIT – IV : Advances in Wireless Networks: 15 PERIODS

Ultra Wide-band Radio communication, Operation of UWB systems, Comparison of UWB with Other Technologies, Major issues in UWB Advantages and Disadvantages of UWB – Optical Wireless Networks, short range Infra red communication, Optical Wireless WDM, Optical wireless WDM for LAN.

Text Books:

1. Pahlavan Kaveh and Krishnamoorthy Prashant – "Principles of Wireless Networks: A unified approach", Prentice Hall Of India, New Delhi, 2011.
2. Siva Ram Murthy. C and Manoj B.S – "Ad Hoc Wireless Networks Architectures and Protocols", Pearson Education, New Delhi, 2011.
3. William Stallings – "High Speed Networks and Internets: Performance and Quality of Service", 2nd Edition, Pearson Education, 2008.

Suggested Readings:

1. Jean Walrand and Pravin Varia – "High Performance Communication Networks", 2nd Edition, Morgan Kaufmann Publishers, 2010.
2. William Stallings – "Wireless Communications and Networks", 2nd Edition, Prentice Hall Of India, 2009.
3. Tanenbaum – "Computer Networks", 4th Edition, Prentice Hall Professional, 2003.
4. NPTEL Link – http://www.youtube.com/watch?v=2d26QaZVSo4

Learning Outcomes:

Unit – I	The students will be able to comprehend the basics of B-ISDN network. They will also be able to enumerate frame relay, ATM network architecture and protocol structure.
Unit – II	The Students will be able to analyze the protocol stack for wireless LAN, Bluetooth and Zigbee.
Unit – III	The learners will be able to understand the functions of Ad hoc networks. They will also be able to describe issues in Ad hoc and different routing protocols.
Unit – IV	The Students will get an idea about wireless networks, UBW and optical wireless networks.

COURSE CODE : BECDEC 709R01 / MCSDEC 709R01
COURSE NAME : EMBEDDED SYSTEMS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

To help the learners understand the concept of embedded system and to make him design his own system.

UNIT – I : Introduction to Embedded Systems: 13 PERIODS

Definition – classification – characteristics of embedded computing applications – design challenge – optimizing design metrics – processor technology – IC technology – design technology – trade-offs.

UNIT – II : System Development and Design Techniques: 15 PERIODS

Execution environment – Memory organization – System startup – Run-time environment – Design methodologies – Design flows – Designing hardware and software components – Requirement analysis – System Analysis and Architecture Design.
Case Studies: Alarm Clock – Elevator Controller – Automated Milk Vending Machine.

UNIT – III : Software Development and Testing: 15 PERIODS

Introduction to software development process and tools – Host and Target Machines – linking and locating software – target programming – issues in hardware and software co-design – Testing on host machine – simulator – laboratory tools.

UNIT – IV : ARM CORTEX M3: 17 PERIODS

Introduction to CORTEX series – Comparison of ARM7TDMI-S and CORTEX M3 – Features of CORTEX M3 – Architecture – Execution Pipeline Stages – Data Types – Register set – Memory Map – Reset Modes – Power Management – Overview of THUMB 2 instruction set.

Text Books:

1. Marilyn Wolf – " Computer As Components: Principles Of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publishers, 2012.
2. Raj Kamal – "Embedded Systems Architecture, Programming and Design" 2nd edition, Tata McGraw Hill, 2011.
3. Cortex-M3 Technical Reference Manual, 2006.

Suggested Readings :

1. Frank Vahid and Tony Giv – "Embedded System Design: A Unified Hardware/Software Approach", 3rd Edition, John Wiley & Sons, 2009.
2. Arnold S.Berger – "Embedded systems design: An introduction to process, tools and techniques", CMP Books, 2002.
3. NPTEL Link – http://www.youtube.com/watch?v=y9RAhEfLfJs&list=PL84637AA7125111CB&index=2

Learning Outcomes:

Unit – I	The learner will have an understanding of various processors.
Unit – II	The learner will be able to learn various design methods required for the design.
Unit – III	The learner will be able to learn about various tools available for design of embedded system
Unit – IV	The learner will have an understanding of ARM cortex processor and its features.

COURSE CODE : BECDEC 710 / MCSDEC 710
COURSE NAME : RADIO NAVIGATION SYSTEMS
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To gain knowledge about INS components and learn how to use different types of Gyroscopes.
- To be able to use radio direction finding equipments and determine range with good accuracy.
- To acquire knowledge of Hyperbolic Systems of Navigation and types of Landing system.
- To learn the usage of GPS system to determine position and velocity of moving targets
- To become familiar with integration of GPS and INS.

UNIT – I : Inertial Sensors and Navigation Systems: 15 PERIODS

Gyroscopes – Mechanical – electromechanical – Ring Laser gyro – Fiber optic gyro, Accelerometers. INS components: transfer function and errors – The earth in inertial space, the coriolis effect – Mechanisation. Platform and Strap down, INS system block diagram, Different co-ordinate systems, Schuler loop, compensation errors, Gimbal lock, Alignment.

UNIT – II : Radio Navigation: 15 PERIODS

Different types of radio navigation – ADF, VOR/DME – Doppler – LORAN, Decca and Omega – TACAN.

Radio Direction Finding – The Loop Antenna – Loop Input Circuits – An Aural Null Direction Finder – The Goniometer – 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..

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

UNIT – III : Approach and Landing Aids: 15 PERIODS

Instrument Landing System (ILS), Microwave Landing System (MLS) – GLS – Ground controlled approach system – surveillance systems-radio altimeter

UNIT – IV : Satellite Navigation and Hybrid Navigation: 15 PERIODS

Introduction to GPS – system description – basic principles – position and velocity determination signal structure – DGPS – Introduction to Kalman filtering – Estimation – Mixed mode navigation – Integration of GPS and INS – utilization of navigation systems in aircraft – Intelligent transport system.

Text Books:

1. Myron Kayton and Walter R.Fried – "Avionics Navigation Systems", John Wiley & Sons, 2nd Edition, 2007.
2. Nagaraja, N.S – "Elements of Electronic Navigation", Tata McGraw-Hill Pub. Co., 2nd edition, 2006.

Suggested Readings:

1. George M Siouris – "Aerospace Avionics System; A Modern Synthesis", Academic Press Inc., 2013.

2. Sen, A.K. & Bhattacharya, A.B – "Radar System and Radar Aids to Navigation", Khanna Publishers, 2010.
3. Albert Helfrick – "Practical Aircraft Electronic Systems", Prentice Hall Education, Career & Technology, 1997.
4. Albert D. Helfrick – "Modern Aviation Electronics", 2nd Edition, Prentice Hall Career & Technology, 1997.

Learning Outcomes:

Unit – I	Learners will be able to understand INS components for radio navigation and uses of different types of Gyroscopes.
Unit – II	Learners will have an understanding of radio direction finding equipments and determination of range with good accuracy.
Unit – III	Learners will get insight into the various landing systems and ground controlled approach used in the airport surveillance.
Unit – IV	Learners will have an understanding of GPS system to determine position and velocity of moving targets and integrate GPS and INS.

COURSE CODE : BECDEC 711 / MCSDEC 711
COURSE NAME : HARDWARE DESIGN WITH BLUESPEC SYSTEM VERILOG
LECTURE PERIODS PER WEEK : 04
TOTAL PERIODS PER WEEK : 04
CREDITS : 04

Course Objective:

- To understand the programming intricacies of Bluespec System Verilog (BSV), the high level design and verification language
- To explore the utilities of BSV as a design entry tool to develop various hardware based applications.

UNIT – I : Verilog Fundamentals: 13 PERIODS

Basic structure – Four Valued Logic – Operators – Concurrent verilog – Continuous Assignment statement – Conditional operator – Delay modeling in verilog – Structural model Verilog – User Defined Primitives – Behavioral model – Cyclic and single pass – Procedural blocking and Non blocking assignment operators – Sequential Conditional statements – Loops – Combinational and Sequential circuits design.

UNIT – II : System Verilog for design: 17 PERIODS

System verilog standard – System verilog origins – Literal values – Data types – Arrays – Packed and unpacked arrays – Multiple dimensions – Dynamic arrays – Associative arrays – Queues – Data declaration – Constants, Variables , Nets, Regs and logic – Operators and expressions – Tasks and Functions – Processes – Combinational, Latched, Sequential, Process control – Introduction to classes and objects – Object Properties – Object methods – Constructors – Static methods – Inheritance – Polymorphism – Clocking blocks – Compiler directives.

UNIT – III : Concepts of Bluespec System Verilog (BSV): 17 PERIODS

Introduction – Design Activities – Key features – Simple example – package – Module definition – Rule – System tasks – Bluespec development workstation – Components of a BSV design – Data types – Type classes and overloading – Data type conversion functions – common scalar types – Variables – Rules, Registers and FIFO – Module hierarchies – Implicit condition of methods – Action value methods – Rwire – Wire types – Wire – Dwire – Pulse wire – Bypass wire – Polymorphic function.

UNIT – IV : Hardware models with BSV: 13 PERIODS

Counter Design – Finite State Machine Modeling – FSM using rules – One hot FSM using rules – stmt FSM – Auto FSM – Traffic Light Controller – UART Transmitter and Receiver Design – SRAM Memory Interface – VGA Interface.

Text Books :

1. Bluespec System verilog User guide, Bluespec Inc, 2012.
2. Rishiyur S. Nikhil and Kathy R. Czeck – "BSV by example", Bluespec Inc, 2010.
3. Stuart Sutherland, Simon Davidmann and Peter Flake – "System verilog for design", 2nd edition, Springer Science + Business Media, LLC, 2006.
4. Michael D.Ciletti – "Advanced Digital Design with the Verilog HDL", PHI, 2003.

Suggested Readings:

1. S.Vijayaraghavan and M.Ramanathan – "A Practical guide for system verilog assertions", Springer Science + Business Media, 2005.
2. System Verilog 3.1a LRM, Accellera Organization Inc, 2004.

Learning Outcomes:

Unit – I	The learners will be able to understand the fundamental programming concepts of Verilog and to design the circuits using Hardware description language.
Unit – II	The learners will be able to understand the programming intricacies of System verilog, its object oriented structure and design systems.
Unit – III	The learners will be able to know the basic programming structure of Bluespec System Verilog (BSV) and to design high level digital systems.
Unit – IV	The learners will be able to develop various hardware model applications using the programming options of BSV.