Department of Electronics and Communication Engineering
Jamia Millia Islamia
B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASE CREDIT SYSTEM (CBCS)
(With effect from 2021-22 sessions)

Codes for nature of courses
L: Lecture courses
P: Laboratory Based courses
S: Seminar/ Independent Study

Category of Courses
DC: Departmental courses
CBCS: Choice based Credit System

Weight age for Course Evaluation
L Lecture T Tutorial P Practical CCA Continuous Class Assessment
MTE Mid Term Exam

B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING-II YEAR

	Third Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	**T**	**P**	CCA	MSE-1	MSE-2		
01	ECS-301	Engineering Mathematics	-	4	3	1	-	10	15	15	60	100
02	ECS-302	Analog Electronics-I	-	4	3	l	-	10	15	15	60	100
03	ECS-303	Circuit Analysis and Synthesis	-	4	3	l	-	10	15	15	60	100
04	ECS-304	Electronic Measurements and Instrumentation	-	4	3	1	-	10	15	15	60	100
05	ECS-305	Logic Design	**CBCS**	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB.)												
06	ECS-310	Analog Electronics-I	-	2	-	-	4	10	10	10	20	50
07	ECS-311	Circuit Simulation Lab	-	2	-	-	4	10	10	10	20	50
08	ECS-312	Logic Design	-	2	-	-	4	10	10	10	20	50
Total				**26**								**650**
	Fourth Semester											
01	ECS-401	Analog Electronics-II	-	4	3	1	-	10	15	15	60	100
02	ECS-402	Signals and Systems	-	4	3	1	-	10	15	15	60	100
03	ECS-403	Electromagnetic Field Theory	**CBCS**	4	3	1	-	10	15	15	60	100
04	ECS-404	Communication Systems	-	4	3	1	-	10	15	15	60	100
05	ECS-405	DSCP	-	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB.)												
06	ECS-410	Analog Electronics-II	-	2	-	-	4	10	10	10	20	50
07	ECS-411	Communication Engg.	-	2	-	-	4	10	10	10	20	50
		Total		**24**							**Total**	**600**

Department of Electronics and Communication Engineering
Jamia Millia Islamia
B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASE CREDIT SYSTEM (CBCS)

Codes for nature of courses
L: Lecture courses
P: Laboratory Based courses
S: Seminar/ Independent Study

Category of Courses
DC: Departmental courses
CBCS: Choice based Credit System

Weight age for Course Evaluation
L Lecture T Tutorial P Practical CCA Continuous Class Assessment
MTE Mid Term Exam

B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING -III YEAR

	Fifth Semester												
S.No.	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)					
								Mid Semester Evaluation			End Semester Evaluation	Total Marks	
					L	**T**	**P**	CCA	MSE-1	MSE-2			
01	ECS-501	Active Filters and Signal Processing	-	4	3	1	-	10	15	15	60	100	
02	ECS-502	Computer Architecture	**CBCS**	4	3	1	-	10	15	15	60	100	
03	ECS-503	Control Systems	-	4	3	1	-	10	15	15	60	100	
04	ECS-504	Digital Circuits and Systems	-	4	3	1	-	10	15	15	60	100	
PRACTICAL (LAB.)													
05	ECS-511	Instrumentation Lab	-	2	-	-	4	10	10	10	20	50	
06	ECS-512	Digital Circuits Lab	-	2	-	-	4	10	10	10	20	50	
		Total		**20**								**500**	
	Sixth Semester												
01	ECS-601	Microprocessor	**CBCS**	4	3	1	-	10	15	15	60	100	
02	ECS-602	Digital Signal Processing	-	4	3	1	-	10	15	15	60	100	
03	ECS-603	Antenna and Wave Propagation	-	4	3	1	-	10	15	15	60	100	
04	ECS-604	Data Communication and Computer Networking	-	4	3	1	-	10	15	15	60	100	
PRACTICAL (LAB/SEMINAR)													
05	ECS-610	Microprocessor Lab	-	2	-	-	4	10	10	10	20	50	
06	ECS-611	DSP Lab	-	2	-	-	4	10	10	10	20	50	
07	ECS-612	Seminar	-	2	-	-	4	10	10	10	20	50	
		Total		**22**							**Total**	**550**	

Department of Electronics and Communication Engineering
Jamia Millia Islamia
B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASE CREDIT SYSTEM (CBCS)

Codes for nature of courses
L: Lecture courses
P: Laboratory Based courses
D: Project based courses leading to desertion (e.g. Major, Minor Project, Training)
S: Seminar/ Independent Study

Category of Courses
CC: Departmental courses
CBCS: Choice based Credit System

Weight age for Course Evaluation
L Lecture T Tutorial P Practical CCA Continuous Class Assessment
MTE Mid Term Exam

B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING -IV YEAR

	Seventh Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	**T**	**P**	CCA	MSE -1	MSE -2		
01	ECS-701	VLSI Design	-	4	3	l	-	10	15	15	60	100
02	ECS-702	Wireless Communication	-	4	3	l	-	10	15	15	60	100
03	ECS-703	Embedded Systems	**CBCS**	4	3	1	-	10	15	15	60	100
04	ECS-704	Digital Communication	-	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB./MINOR PROJECT)												
05	ECS-711	VLSI Lab	-	2	-	-	4	10	10	10	20	50
06	ECS-712	Minor Project	-	4	-	-	12	20	20	20	40	100
07	ECS-713	Industrial Training*	-	1	-	-	-	15	-	-	10	25
Total				**23**								**575**
	Eighth Semester											
01	ECS-801	Microwave Engineering	**CBCS**	4	3	1	-	10	15	15	60	100
02	ECS-802	Optical Fiber Communication	-	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB./MAJOR PROJECT)												
03	ECS-811	Microwave Engineering Lab	-	2	-	-	4	10	10	10	20	50
04	ECS-812	Major Project	-	12	-	-	16	60	60	60	120	300
	Total			**22**	**Total**							**550**

*Students will undergo the Industrial Training of minimum 2-weeks during summer vacation after the examination of VI Semester are over. And submit a report till the end of VII semester, the practical exam of the same will held along the practical exams of VII Sem.

Total Number of Credits including 1st year= 192 (137+55)

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

III SEMESTER

ENGINEERING MATHEMATICS

Paper Code **ECS-301**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I APPLICATIONS OF MULTIPLE INTEGRALS AND VECTOR CALCULUS

Applications of double and triple integrals (Cartesian, polar, cylindrical and spherical coordinate) in finding the centre of gravity, moment of inertia, curved surface area and volume; Problems on Green's theorem, Gauss Divergence theorem, Stoke's curl theorem (Cartesian forms without proof).

UNIT- II APPLICATIONS OF LAPLACE TRANSFORM

Applications of Laplace and inverse Laplace transform in finding the particular solution of ordinary linear differential equation of higher order with constant and variable coefficients, integral equations, integro-differential equations.

UNIT- III FOURIER SERIES, FOURIER TRANSFORM

Fourier's series (full range and half range) for arbitrary period, Representation of a function in terms of Fourier integrals, Fourier Sine Integral and Fourier Cosine Integral, Fourier transform-finite& infinite, Fourier sine & cosine transforms and their inverse transforms, Properties of different transforms and associated theorems.

UNIT- IV DIFFERENCE EQUATIONS AND Z-TRANSFORM

Complementary function and particular integral of linear difference equations with constant and variable coefficients, Z-Transform and inverse Z-Transform (without proof) and its application in the solution of linear difference equations with constant coefficients.

UNIT-V HIGHER CALCULUS

Extremals of functionals by calculus of variations, Beta and Gamma functions, Legendre and Jacobi forms of Elliptic integrals of different kinds.

Pre-requisite Basic Mathematics

Course/Paper:

Text Book: B.S. Grewal, "Elementary Engineering Maths and HigherEngineering Maths", Khanna Publishers

Reference Books:

1. A.B. Mathur & V.P. Jaggi, “A text book of Engineering Maths and Advanced Engineering Mathematics”, Khanna Publishers.

2. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons Inc.

3. B. V. Ramana, “Higher Engineering Mathematics”, Tata Mc Graw Hill

4. R. K. Jain and S. R. K. Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing house

5. Rakesh Dubey, “Mathematics for Engineers, Vol- I and II”, Narosa Publishing house

Course Outcome:

CO1. Thorough understanding of applications of multiple integrals and vector calculus.

CO2. An ability to apply Laplace transform to engineering problems.

CO3. An ability to apply Fourier series and Fourier transform and understand its physical implications.

CO4. Thorough understanding of Difference equations and z-transform.

CO5. An ability to solve engineering problems by application of higher calculus such as Beta and Gamma functions, Legendre and Jacobi forms of Elliptic integrals of different kinds.

Computer usage/

Software required:

EXCEL, MATHEMATICA, MATLAB

ANALOG ELECTRONICS I

Paper Code	**ECS-302**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT-ISMALL SIGNAL ANALYSIS OF BJT** Transistor biasing and stabilization, small signal low frequency h-parameters and hybrid-$\prod$ model, cascaded amplifiers, design problems, Darlington pair, Frequency response of RC- Coupled amplifiers. **UNIT – IIJFET AND MOSFET AMPLIFIERS** Construction of JFET and MOSFETS, characteristics of JFET and MOS FETs Biasing of JFETs, and MOSFETs, Analysis of low frequency small signal FET amplifiers, VMOS and CMOS, Design problems. **UNIT- IIITHE TRANSISTOR AT HIGH FREQUENCY** The hybrid-$\prod$ CE transistor model, hybrid-$\prod$ conductance, hybrid-$\prod$ capacitances, validity of hybrid-$\prod$ model, variation of hybrid $\prod$ parameters, CE short circuit current gain, gain with resistive load freq. response, single stage CE transistor amplifier, the gain band width products, emitter follower at high frequencies. **UNIT- IV LARGE SIGNAL AMPLIFIERS** Power dissipation in transistor, harmonic distortion, amplifiers Classification (Class A, Class B, Class AB and Class C) efficiency, Push-pull and complementary push-pull amplifiers, Introduction to tuned amplifiers. **UNIT-VFEED BACK AMPLIFIERS AND OSCILLATORS** Ideal feedback configuration, Voltage-series and shunt feedback, current-series and shunt and its effects on input and output impedances, tuned oscillators (Hartley and Colpitt's), Introduction to crystal oscillators.
Pre-requisite	Basic Electronics
Text books	1. Millman and Grabel, "Microelectronics", Mc Graw Hill, 2nd edition

2. Sedra and Smith, “Microelectronic circuits”, Oxford University Press, 7th edition

3. R. Boylestad and Nashelsky, “Electronic devices and Circuit Theory”, Pearson,10th edition.

4. Horenstein, “Microelectronic circuits and Devices”, PHI, 1996.

5. Jacob Millman and Christos. C. Halkias ‘Integrated Electonics’, Tata Mc Graw Hill, 1991

Reference Book

P. Gray, R. Meyer, S.Lewis and P. Hurst, “Analog Integrated Circuits”, 3rd edition, JohnWiley, 2007.

Course Outcomes

CO1: To understand and analyze the different biasing techniques used in BJTs andanalyze different amplifier circuits using h-parameter ac equivalent models.

CO2: A thorough understanding ofa working principles, characteristics and basic applications of FET and analyze low frequency small signal FET amplifier circuits.

CO3: Student should be able to analyze high frequency response of BJT amplifier using hybrid-π model and derive the gain under loaded and unloaded conditions. Understand high frequency response and gain bandwidth relationship for amplifier design.

CO4: Student should be able to classify the power amplifiers such as class A class B etc. and interpretation of performance characteristics of these transistors amplifiers

CO5: Student should be ableto understand the effect of negative feedback and positive feedback and apply the knowledge gained in the design of transistorized circuit amplifiers and Oscillators.

Computer Usage/

PSPICE

Software required:

CIRCUIT ANALYSIS AND SYNTHESIS

Paper Code **ECS-303**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I BASIC CIRCUIT FUNDAMENTALS

Circuit elements: passive and active elements, independent circuit elements, Independent and dependent sources, Source transformation, Review of Ohm's law, Kirchoff's law, Node and mesh-current method compared. The dot-convention in magnetically coupled circuits, Dual circuits, The phasor concept, DC analysis using PSPICE, Analysis of RLC circuits.

UNIT- II NETWORK FUNCTION AND TWO PORT PARAMETERS

The concept of complex frequency, Review of Laplace transform(LT), step impulse, ramp, sinusoidal and exponential function and their LT's, initial conditions in circuits, time-domain analysis of circuits using LT, poles and zeros of a network function, restrictions on poles and zeros location, stability of active network, two-port parameters, inter-connection of two-port networks, PSPICE analysis of RLC circuits.

UNIT- III CIRCUIT THEOREMS AND OTHER APPLICATIONS

Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Substitution theorem, Tellegen's theorem- and their application to linear, AC and DC, active and passive circuits, Use of PSPICE for DC analysis.

UNIT- IV GRAPH THEORY AND STATE VARIABLE ANALYSIS

Terminology and definitions: graph and sub-graph, tree and co-tree, twig and link, cut-set matrices, circuit analysis using graph theory concept. State variable analysis of circuits: state variables, formation of state equations for circuits and their solution.

UNIT-V PASSIVE NETWORK SYNTHESIS

Analysis versus synthesis, positive real function, properties of passive network, synthesis of RC, RL and LC network (foster and Cauer forms) Use of PSPICE for analysis and synthesis of circuits.

Pre-requisite Basic Circuit Theory

Course/Paper:

Text Book: Hayt Jr. and Kemmerly, “Engineering Circuit Analysis”, Mc Graw Hill Book Co. 1987

Reference Books:

1. M L Van Valkenburg, “Network Analysis”, Prentice Hall of India, New Delhi, 1985

2. FF Kuo, “Network Analysis and Synthesis”, John Wiley and Sons Inc. , 1985

3. Sudhakar A. Shyammohan, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill Publishing Company Ltd. New Delhi, IIIrd edition, 2007

Course Outcome:

CO1. Analyze various electrical components in networks & understand application of KCL and KVL in electrical networks.

CO2. Understand the Thevenin and Norton Theorem,Nodal and Mesh analysis to express complex circuits in their simpler equivalent forms.

CO3. Understand linearity and superposition concepts and use them to analyse RL, RC & RLC circuits in time and frequency domains.

CO4. Understand the concepts of Graph Theory and use them in solving electrical circuits.

CO5. Learn the method of synthesizing an electrical network from given Impedance/Admittance function.

Computer usage/ PSPICE

Software required:

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Paper Code **ECS – 304**

Course Credits 4

Lectures/Week 3

Tutorial/week 1

Course Description

UNIT-I ELECTRONIC INSTRUMENTATION

Electronic instruments- working classification, their sensitivity; errors- its classification, sources or error; voltage, current and impedance measurement; electronic multimeter.

UNIT-II DIGITAL INSTRUMENTATION

Digital Instruments-classification, their applications;block diagram for analog-to digital conversion; Digital voltmeters(DVM)-successive approximation type, ramp type and integration dual slope type; ammeters; digital frequency meter.

UNIT-III ANALYZERS & RECORDERS

Spectrum Analyzer-its classification and application, waveform analyzer, harmonic distortion analyzer, fourier analyzer, cathode ray oscilloscope (CRO), recorders and their applications.

UNIT-IV PRECISION MEASUREMENT

Use of AC Bridges, measurement of R-L-C, measurement of frequency, dissipation factor of capacitance; [Maxwell's, Hay's, Andersons, wein frequency, De-Sauty Bridge, kelvin's bridge, wagner ground connections], sources of error,unbalance conditions.

UNIT-V COMMERCIAL MEASURING INSTRUMENTS

Q-meter- their classification and applications, digital multi-meter, digital storage oscilloscope(DSO)-its working, classification & applications; Transducers – strain gauge, variable R,L,C transducer, pressure & temperature transducers

Pre-requisite course/paper: Analog concept of measurement & basics of Instrumentation

Text Book:

1.WD Cooper, &A.D Helfric “Modern Electronic Instrumentation and Measurement Techniques”,PHI Learning Private Limited New Delhi,2011.

2. E.W. Golding et.al, “Electrical Measuremt and Measuring Instrument”, Jobs Publications.

Reference Books:

1. A.K.Sawhney, “Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai & Sons,1992.

2. R.K.Rajput, “Electrical and Electronic Measurements and Instrumentation”, S.Chand &Company LTD.,2011.

3. Ashfaq Hussain, “Electrical machines”, Dhanpat Rai & co. Pvt LTD.,2012.

Course Outcome:

CO1. Thorough understanding of electronic instruments-basis of their classification estimation of various types of errors in measurement, their probability and their minimization.

CO2. Understanding towards the basic principle of digital methods of measurement of electrical parameters& various types of DVMs.

CO3. Understanding towards the analysis of various waves using Spectrum analyzers ,wave analyzers & recorders.

CO4. An understanding of Null and balance methods of measurement and use of bridges for the measurement of passive elements and their affecting factors and an ability to design various A.C. bridges to measure the said quantities.

CO5. A thorough understanding of the fundamental concept and working knowledge of transducer, sensor, Q-meter & DSO .

LOGIC DESIGN

Paper Code	**ECS-305**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT- I SWITCHING ALGEBRA AND COMBINATIONAL LOGIC

Development of Boolean Algebra, truth functions, AND OR and NOT operators, laws of algebra, reducing Boolean expressions, universal building blocks, Karnaugh mapping, minterms, maxterms, solving digital problems using sum of the products and product of sums reduction hybrid functions, incompletely specified functions (don't care combinations).

UNIT-II SEQUENTIAL CIRCUITS (FLIP-FLOP AND RIPPLE COUNTERS)

Introduction to asynchronous systems, flip-flop: RS, T, D, JK, master slave JK, Ripple counters-shortened modulus, up and down counter designs, few application of ripple counter.

UNIT-III SEQUENTIAL CIRCUITS (PARALLEL COUNTERS AND ASYNCHRONOUS CIRCUITS)

Parallel counters, type T counter design, up and down counters, non-sequential counting (skipping states), type D counter design, shift registers, ring counters, type JK counter design, controlling the counter to count through more than one set of states.

UNIT-IV LOGIC FAMILIES

Diode transistor logic (DTL), Transistor-Transistor logic (TTL) as derived from DTL, typical TTL NAND gate, function of the input transistor, volt-ampere characteristics, fan-in and fan-out calculations, output stage: totem-pole and modified totem-pole, introduction to Emitter Coupled Logic (ECL), Integrated Injection Logic (IIL), and MOSFET, Comparison of various logic families.

UNIT-V ADDERS, SUBTRACTORS, ADC AND DAC

Binary half adder, full adder design, parallel adder, BCD adder, addition of more than two numbers, subtractor, fast adder (look-ahead carry), parity checker/generator, multiplexer/ demultiplexer, some applications, Digital to analog converter - weighted register, R-2R ladder network, Analog to digital converter, successive approximation type, dual slope type.

Pre-requisite Fundamentals of Abstract Algebra

Course/Paper:

Text Book: Herbert Taub and Donald Schilling, "Digital Integrated Electronics" Tata MC Graw Hill. 1988

Reference Books:

1. Willam H. Gothman, "Digital electronics –An Introduction to Theory and Practice", 2nd Edition PHI. 1992
2. Thomas L Floyd, "Digital Fundamentals" Pearson Education, 2011
3. Morris Mano, "Digital Circuits and Logic Design", PHI. 1987

Course Outcome:

CO1. A thorough understanding of basic building blocks of Digital Circuits and Boolean Algebra and ability to design simple combinational circuits by using K-Maps.

CO2. A thorough understanding of basic storage units and their need in sequential circuits, and the ability to design ripple counters and the appreciation of their limitations.

CO3. The ability to design synchronous counters using type -T, Type-D and Type-JK design philosophies and the appreciation of how they overcome the limitations of ripple counter.

CO4. A thorough understanding of circuits like Adders, Subtractors, Parity Checkers/Generators , Multiplexers/De-Multiplexers, A/D and D/A converters etc. and a co-relation with the design insights already gained in CO1 and CO2.

CO5. A thorough understanding of the implementation of basic building blocks in DTL,TTL,MOS,CMOS,ECL and I^2L Logic Families and a qualitative comparison of their performance.

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

IV SEMESTER

ANALOG ELECTRONICS II

Paper Code **ECS-401**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description **UNIT-I DIRECT- COUPLED AMPLIFIERS**

Difference amplifier, the emitter-Coupled differential amplifier, Common-mode gain, differential- mode gain, (CMRR), current mirrors, active loads, BJT-input stage, gain stage, level shifter, output stages, complete op-amp cascade with qualitative analysis, frequency response and compensation.

UNIT-IIOP-AMP APPLICATIONS

Brief review of inverting/non-inverting VCVS, Integrators, differentiators, ICVS and VCIS, instrumentation amplifier, logarithmic amplifiers, Log/Antilog modules, temperature compensation, op-amp-parameters and their measurements.

UNIT-III WAVEFORM GENERATORS AND WAVESHAPING

Op-amp comparators, regenerative comparators (Schmitt trigger), waveshaping, zero crossing detector, astable and monostable multivibrators, square/triangular wave function generator, saw-toothwave generator, sample and hold circuit, precision rectifiers, peak detector and window detector.

UNIT- IV I C TIMER AND IC PLL

The IC 555 timer, operational modes, time delay, astable and monostable operations, VCO etc., phase locked loop IC 565 (PLL), principle of operation, three modes of operation, PLL applications frequency synthesis, FM demodulaton, frequency to Voltage Converter etc.

UNIT- V ANALOG MULTIPLIER AND VOLTAGE REGULATORS

Analog multiplier using BJTs, IC analog multiplier and its applications, voltage regulators: op-amp based regulators, IC regulators, fixed voltage regulators (78/79XX), 723 IC regulators, current limiting and current foldback circuits, SMPS.

References Books

1. Sedra and Smith, “Microelectronic circuits”, Oxford university press.
2. S. Soclof, “Applications of Analog Integrated circuits”, PHI.
3. Coughlin and Driscoll, “Operational amplifiers and Linear Integrated circuits”, PHI
4. J. Millman and Grabel, “Microelectronics”, McGraw Hill Book Co.
5. K. Laker, “Design of Analog Integrated Circuits and Systems, Tata McGraw Hill.

Course Outcomes

CO1: Ability to describe and analyze the characteristics of differential amplifiers and their DCand small signal characteristics. Ability to realize different gains like common mode and differential mode and the CMRR of the differential amplifier can easily be calculated.

CO2: Ability to design, construct, measure and realize various applications of Op-amp like VCVS, ICVS and VCIS, Integrators, differentiators, instrumentation amplifier, Log/Antilog modules and other different parameters.

CO3: Ability to understand and design various wave generator circuits and shaping circuits like Schmitt trigger, zero crossing detector, astable and monostable multivibrators, square/triangular wave function generator, saw-tooth wave generator, sample and hold circuit, precision rectifiers, peak detector and window detector.

CO4: Ability to design, construct and understand the various application of the op-amp based circuits like VCO, IC 555 timer based circuits and IC 565 PLL based circuits.

CO5: Ability to Design, construct, and take measurement of various analog multiplier, Voltage regulator and Op-amp based circuits to compare experimental/ simulated results in the laboratory with theoretical analysis.

Computer usage/ Software required: PSPICE

SIGNALS AND SYSTEMS

Paper Code **ECS-402**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I REPRESENTATION OF DISCRETE AND CONTINOUS TIME SIGNALS AND SYSTEMS.

Continuous time and discrete time signals, Representation and classification, Convolution, Representation of linear time invariant discrete and continuous time systems, Laplace transformation and its application in system analysis.

UNIT- II ANALYSIS OF CONTINUOUS TIME SIGNALS AND SYSTEMS

Fourier series representation of periodic signals, Response to periodic signal, Fourier transform and its properties, Inverse Fourier transforms, Frequency response function, Computation of response from the Fourier transform, Bandwidth concept, Impulse response of the ideal filters.

UNIT-III ANALYSIS OF DISCRETE TIME SIGNALS AND SYSTEMS

Z-transform and its properties, Inverse Z-transform, Frequency response of discrete time signals, Discrete Time Fourier Transform (DTFT) and its properties.

UNIT-IV SAMPLING

Sampling of signal, Sampling theorem, and Frequency spectrum effect of under sampling, Reconstruction of signals, Sampling in frequency domain, Sampling of continuous time signal.

UNIT-V RANDOM SIGNAL AND NOISE

Random variables, Probability distribution and density function, Uniform Gaussian, Exponential and Poisson distributions, Statistical averages, Stochastic processes, Systems with stochastic inputs, Auto and Cross correlation functions, power spectral density, Noise and its types and mathematical representation.

Pre-requisite

Course/Paper: Basic Mathematics

Text Book: A.V. Oppenheim, Wilsky & Nawab, “Signals & Systems”, PHI, 1998.

Reference Books:

1. S. Haykin, “Communication Systems”, Wiley Eastern, 1992.

2. A.V. Oppenhiem& R.W. Shafer, “Digital Signal Processing”, Prentice Hall, 1992.

3. G.R. Copper & C.D. McGillen, “Methods of Signals & System Analysis, Holt Renehart&Winstons.

Course Outcome:

CO1. Ability to represent and perform various operations on continuous time(CT) and Discrete time(DT) signals, analyze CT and DT signals in time domain using convolution, Characterize and analyze properties of CT and DT signals and systems, analyze CT systems using Laplace Transform and define system stability.

CO2. Ability to represent periodic signal using Fourier series, representation of periodic and non-periodic signal using Fourier Transform, ability to determine impulse response & frequency response functions and understanding of properties of Fourier Series and Fourier Transform.

CO3. Ability to analyze and define stability of Discrete time systems using Z-Transform, Understanding of properties of z-transform and should be able to determine Discrete Time Fourier Transform (DTFT).

CO4. A thorough understanding of the process of sampling and reconstruction of signal, effects of under-sampling and over-sampling for Continuous time signals.

CO5. A thorough understanding of random variables and various parameters like CDF, PDF, Poisson, Gaussian distribution and power spectral density of signals, understanding of different types of noise in system and their effects.

ELECTROMAGNETIC FIELD THEORY

Paper Code **ECS-403**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course Description

UNIT-1VECTOR ANALYSIS, COULOMB'S LAW AND ELECTRIC FIELD INTENSITY.

Review of scalars and vectors, vector algebra, cartesian co-ordinate system, vector components and unit vectors, vector field, dot product, cylindrical and spherical coordinate systems, experimental law of Coulomb, electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of a sheet of charge.

UNIT-IIELECTRIC FLUX DENSITY, GAUSS'S LAW, DIVERGENCE, ENERGY AND POTENTIAL.

Electric flux density, Gauss's Law, application of Gauss's Law, some symmetrical charge distributions, differential volume element, divergence, vector operator ∇ and divergence theorem, Energy expended in moving a point charge in an electric field, Line integral, Definition of potential difference and potential, Potential field of a point charge, Potential field of system of charges-conservative property, Potential gradient, Dipole, Energy density in electrostatic field.

UNIT-III CONDUCTORS, DIELECTRICS, CAPACITANCE, POISSON'S AND LAPLACE'S EQUATIONS.

Current and current density, continuity of current, semiconductors, Poisson's and Laplace's equations, product solution of Laplace equation.

UNIT-IV STEADY MAGNETIC FIELD AND AMPERE'S CIRCUITAL LAW.

Biot-Savart's Law, Ampere's circuital Law, Curl, Stoke's theorem, magnetic flux and magnetic flux density.

UNIT-V MAXWELL'S EQUATIONS.

Faraday's Laws, displacement current, Maxwell's equations in point from, Maxwell's equations in integral form

Pre-requisite Course/ Paper

Vector concept

Text Book

W H Hayt, J A Buck and M Jaleel Akhtar, "Engineering Electromagnetics", McGraw Hill Education, 8th edition.

Reference Books

1. Joseph A Edminister, "*Electromagnetics*". Schaum's Outline Series in Engineering. M.c.Graw Hill Book, Co, new Delhi-1986.

2**.** K E Lonngren, S V Savov and R J Jost, "Fundamentals of electromagnetic with MATLAB", PHI, 2nd edition.

3. A Pramanik, "Electromagnetism , Volume 1-(Theory)", PHI, 2014.

4. D K Cheng, "Field and wave electromagnetics", Pearson, 2nd edition.

5. M N O Sadiku, "Principles of electromagnetism", Oxford, 4th edition.

6. S Bhooshan, "Fundamentals of engineering electromagnetics", Oxford, 2013.

Course Outcome

CO1. A thorough understanding of transformations between cartesian, cylindrical and spherical coordinate systems and application of Coulomb's law to compute electric field intensity due to various charge distributions.

CO2. An ability to apply Gauss's law to symmetrical charge distributions, understanding of divergence theorem and potential field computation due to system of charges.

CO3. A thorough understanding of continuity of current and application of Poisson's and Laplace's equations to determine parameters like potential and capacitance.

CO4. A thorough understanding of laws and theorems related to magnetostatics such as Biot-Savart's law, Ampere's circuital law, Stoke's Theorem etc.

CO5. An ability to interpret and identify various EM fields as Maxwellian on the basis of Maxwell's equations.

COMMUNICATION SYSTEMS

Paper Code **ECS-404**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course Description UNIT- I AMPLITUDE MODULATION (AM)

Basic Communication System Model, Modulation, Need of Modulation, double side band suppressed carrier modulation(DSB-SC), single side band (SSB),Independent Sideband (ISB) Modulation, Vestigial Sideband (VSB) Transmission, Comparison of various AM Systems,

UNIT- II ANGLE MODULATION

Angle Modulation: Frequency and Phase Modulation.

Frequency Modulation (FM): Time Domain and Frequency Domain Representation, Power Distribution and Bandwidth of FM Signal, Carlson's Rule, Narrow Band FM (NBFM), Wide-Band FM (WBFM), Effect of Noise in FM signal-Noise Triangle, Emphasis and De-emphasis.

Phase Modulation (PM): Brief Description of Phase Modulation, Relation between FM and PM.

Generation of FM Signals: Direct and Indirect Methods

- **Direct Method:** Varactor Diode FM Modulator
- **Indirect Method:** Armstrong Method for NBFM, Generation of WBFM.
- **Audio FM Generation:** Monophonic and Stereophonic.

UNIT III RADIO RECEIVER

Demodulation: Synchronous and Asynchronous Demodulation, Effect of Frequency and Phase Errors in Synchronous Demodulation.

Carrier Recovery: Square-Law PLLand Costas Loop

Demodulation of AM Signals: Demodulation of DSB-FC, DSC-SC, SSB and VSB AM Signals

Demodulation of FM signal: Frequency Discriminators and Phase Discriminators, Foster-Seeley Phase Discriminator, Ratio Detector.

Radio Receivers: Superhetrodyne Radio Receiver, Advantages.

Superhetrodyne AM Receiver: Block Diagram, Intermediate Frequency (IF), Automatic Gain Control (AGC).

Superhetrodyne FM Receiver: Block Diagram, Intermediate Frequency (IF), Automatic Frequency Control (AFC), Monophonic and Stereophonic FM Receivers.

Performance of Radio Receivers: Sensitivity, Selectivity, Fidelity, Image Frequency and Image Frequency Rejection Ratio

UNIT-IV NOISE PERFORMANCE OF COMMUNICATION SYSTEMS

Bandpass Noise Representation, Concept of Pre-envelope, Signal-to-Noise Ratio (SNR) in Radio Receivers

Noise in AM Receivers: Noise in AM Receivers Using Coherent Detection (DSB-SC and SSB), Noise in AM Receivers Using Envelop Detection(DSB-FC) and Threshold Effect.

Noise in FM Receivers: Noise in FM Receivers when Signal Strength is greater than the Noise, Capture Effect, Threshold Effect and its Improvement through De-emphasis.

UNIT-V PULSE MODULATION

Sampling Theorem, Pulse Modulation, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Frequency Division Multiplexing (FDM), L-Carrier Hierarchy System, Time Division Multiplexing (TDM), Brief Description of T-Carrier Hierarchy System.

Pre-requisite

Course/Paper Maths III

Text Book

1. **J G Proakis &MasoudSalehi,** "Fundamentals of Communication Systems", Pearson Education, 2013.

2. **SimonHaykin**, "Communication Systems", 4thEdn.,Wiley Eastern Ltd., 2001.

Reference Books

1**. B P Lathi & Zhi Ding**, "Modern Digital & Analog Communication Systems", Oxford University Press, 4th Edn., 2011.

2. **LeonWCouchII**," Digital &Analog Communication Systems", Pearson Education, 8thEdn., 2014.

Course Outcome:

CO1: To become familiarize with the Amplitude Modulation, its various forms, its time-domain and frequency-domain representation, and generation of its various forms.

CO2: To have thorough understanding of Frequency and Phase Modulation, time-domain and frequency-domain representation of FM, Narrowband and Wideband FM, and generation FM signals.

CO3: To study the demodulation techniques of AM and FM signals, AM and FM receivers and performance parameters of radio receivers.

CO4: To study the Bandpass and Lowpass noise in communication systems and the noise performance of various AM and FM receivers.

CO5: To become familiarize with Pulse Modulation techniques and various Multiplexing schemes and their applications in communication systems.

Computer usage/

Software required: MATLAB

DATA STRUCTURE AND COMPUTER PROGRAMMING

Paper Code	**ECS-405**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT- IBASICS OF DATA STRUCTURE AND ALGORITHMS

Difference between data structure and data type, built in data structure i.e. array and user defined data structure, i.e. stack, queue, etc. **Array:** Representation of an array, types of array, i.e. One-dimensional array, two-dimensional array, Three-Dimensional array and n-dimensional arrays, row and column major implementation of different types of array. **Algorithm:** Time and space complexity of algorithm; asymptotic notation: Big oh notation, etc. **Sorting Algorithm:** Bubble sort, selection sort, Insertion sort, Merge sort and Quick Sort. **Searching Algorithm:** Linear search and binary search.

UNIT- II STACKED QUEUE &LINKED LIST

Stack: Introduction: Push and Pop Operation, Array implementation of stack; application of stack: evaluation of a postfix, conversion of an expression from infix to postfix, recursion and tower of Hanoi problem; **Queue:** Introduction, operation on queue, i.e. insertion and deletion, full and empty types of queue: linear queue, circular queue, priority queue and doubly ended queue, queue implementation. **Linked List:** Concept of linked list, inserting and removing notes from the linked list, types of linked list, single and double linked list, implementation of stack and queue using linked list.

UNIT- III TREES AND GRAPHS

Trees: Concepts of a tree, binary trees, strictly binary trees, complete binary trees, almost complete binary trees, height and depth of a tree, operation on tree, array and linked representation of binary trees, tree search algorithm, binary search trees (BST), tree traversal algorithms: in-order, preorder & post-order.

UNIT-IV BASICS OF C++

Beginning with C++, constants, variables, operators, expressions, control structures, loops, arrays and pointers, functions: functions prototypes, call by value, call by reference, inline functions, function overloading.

Class and Objects: specifying a class, program based on classes and objects

UNIT-V ADVANCED C++

Constructors and destructors, multiple constructors in a class, dynamic constructors and destructors, operators overloading: rules for operator overloading, overloading unary and binary operators, polymorphism and related programs

Pre-requisite Fundamentals of Computing

Course/Paper:

Text Book/

Reference Book:

1.Seymour Lipschutz, “Theory and Problems of Data Structures” Tata McGraw-Hill Book Company Ltd.

2. Seymour Lipschutz, “Data Structure with C”, Shaum’s Outline series.

3. DebasisSamanta, “Classic Data Structure”, Prentice Hall of India Pvt. Ltd.

4. Balagurusami, E, “Object Oriented Programming in C++”, Tata McGraw-Hill Book Company Ltd.

5. Herbert Schildt, “C++: The Complete Reference”, Tata McGraw-Hill Publishing Company Ltd.

6. Denitel, H. M. &Deltel, P.J., “C++: How to program”, Prentice Hall of India Pvt. Ltd.

Course Outcome:

CO1: To understand the properties of various data structures & possess the knowledge of various existing algorithms.

CO2: To understand the use of linear and non-linear data structures like stacks, queues & linked lists.

CO3: To apply algorithms and use of trees and graphs as tools to visualize and simplify the problems.

CO4: To understand & create programs in C++ using sound OOP practices and proper program structuring.

CO5: Understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading

Computer usage/ Turbo C++ 3.0

Software required:

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

V SEMESTER

ANALOG FILTERS AND SIGNAL PROCESSING

Paper Code **ECS-501**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I ACTIVE ELEMENTS AND THEIR APPLICATIONS

Introduction to active elements, primary and secondary building blocks, operational amplifier (op-amp), operational transconductance amplifier (OTA), immittance converter, pathological elements (Nullator, Narator and Nullor) and their use in realizing controlled sources and other active elements, active networks synthesis.

UNIT II ACTIVE FILTER DESIGN

Active filter synthesis, cascade approach, first order networks, simulated inductance approach and FDNR approach to op-amp RC Filters, the biquad (single amplifier and multi-amplifier biquads) filters, negative feedback topology positive feedback topology, some design problems, introduction to active-R filters, Active-C-filters.

UNIT III FILTER APPROMIMATION MODELS

Introduction to analog filter theory, filter approximations, Butterworth approximation, Chebyshev approximation and inverse Chebyshev approximation, frequency transformations, low pass-low pass, low pass-high pass, low pass-band pass and low pass to band reject transformations, some design problems.

UNIT IV SENSITIVITY FUNCTION

Sensitivity study, sensitivity function, magnitude and phas sensitivities, single parameter sensitivity, multiple parameter sensitivity, gain sensitivity, root sensitivity, general relation of network functions sensitivities.

UNIT V SWITCHED CAPACITOR FILTERS

The MOS switch, the switched capacitor/resistor equivalence, analysis of switched capacitor filters using charge conservation equations, switched capacitor biquads, design examples.

Text/

Refrence Books

1.Wai Kai Chen, “Passive and Active Filter Theory and Implementations:, John Wiley and Sons, 1986

2. M.E. Vanvalkenburg,” Analog Filter Design”, Jolt Rinehart & Winston, New Yark, 1982.

3. Y.F. Lam, “Analog and Digital Filters: Design and Realization”, Englewood N.J., 1979

4. Gobind Daryanani, “Principles of Active network Synthesis and Design”, John Wiley, New Yark,. 1976.

5. M.E. Van Valkenburg and Kinariwala, “Linear Circuits”, Prenticed Hall of India.

6. R. Schaumann, M.S. Ghausi and K.R. Laker, “Design of Analog Filters: passive, active RC and switched capacitors”, Prentice Hall, Englewood cliffs, NJ, 1990.

Course Outcome:

CO1. An ability to develop thorough understanding of the different active and Pathological elements.

CO2. Capability to develop skills in analysis and design of various analog filters.

CO3. Ability to understand the approximation in the Analog Filters and analyze their design.

CO4. Ability to develop skill regarding sensitivity functions of various filter transfer functions.

CO5. Capability to understand principle of operation of switched-capacitor filter circuits.

Computer usage/

PSPICE

Software required:

COMPUTER ARCHITECTURE

Paper Code **ECS-502**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I HARDWARE REQUIREMENTS AND MICRO-OPERATIONS

Philosophy of digital systems and computer design, review of digital hardware and MSI/LSI/VLSI devices description and applications. Register transfer and micro-operations: arithmetic, logic and shift micro-operations, simple computer design.

UNIT- II SYSTEM SOFTWARE AND PERIPHERAL DEVICES

Assembly language, the Assembler, introduction to compiler, important peripheral devices, PC family.

UNIT III PROCESSOR DESIGN

Processor organization, arithmetic and logic unit (ALU), design of arithmetic and logic unit, design of accumulator, introduction to parallel computing-Pipeline processing.

UNIT-IV LOGIC CONTROL DESIGN

Processor organization, hardware control, micro program control, control of processor unit, hardwired and PLA controller, micro program sequencer.

UNIT-V COMPUTER DESIGN, I/O & MEMORY ORGANIZATION

Design aspects related to: systems configuration, computer Instruction-set, timing and control, instruction executions, design of Control (PLA &micro program) computer control. Review of I/O Interface and data transfers, review of various memories: bulk magnetic storage, auxiliary memory hierarchy, associative, virtual and cache memories, memory-management hardware

Pre-requisite Basic Digital Logic

Course/Paper:

Text Book: M. Morris Mano, “Computer System Architecture”, 2nd Edition, PHI Ltd. 1982.

Reference Books: 1. M. Morris Mano, “Computer Engineering Hardware”, PHI, 1988.

2. M. Morris Mano, “Digital Logic and Computer Design”, PHI Ltd., 1979.

3. Hayes, “Computer Architecture” McGraw Hill.

4. Hanacher “Computer Organization” Prentice Hall.

Course Outcome:

CO1. Thorough understanding of the basics of computer architecture and organization.

CO2. An ability to create an assembly language program to program a microprocessor system.

CO3. Capability to easily deal with processor design and their modification for high performance and multi-tasking.

CO4. Capability to articulate design issues in the development of control unit or other components that satisfy design requirements and objectives.

CO5. An ability to use the new technologies in memory organization of computers.

Computer usage/

Basic computer (Pentium 4)

Software required:

CONTROL SYSTEMS

Paper Code	**ECS-503**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course Description	**UNIT – I** Basic Control System Components: Classification of Systems, Block Diagrammatic description, Reduction of Block diagrams. Properties of systems: Linearity, Time Invariance, Stability, Causality. **UNIT – II** Open Loop and Closed Loop (Feedback) System. Transfer Function, Impulse Response, Signal Flow Graphs and their use in determining function of systems Poles, zeroes and their significance, stability analysis of these systems, Routh –Hurwitz criterion. **UNIT - III** Transient and steady state analysis of LTI systems and Frequency Response, Tools and Techniques of LTI Control Systems-Root Locus, Bode Plot, Nyquist Plot. **UNIT - IV** Control Systems compensators: Elements of lead and lag compensation, Elements of proportional-Integral-Derivative (PID) control. State Variable representation and solution of state equations of LTI systems, controllability and observability, Liapunov stability analysis. **UNIT – V** Digital and Microprocessor based control Systems: Introduction, Configurations of computer control, Control Algorithms, Jury's stability criterion of digital control Systems, Microprocessor based control systems.
Pre –Requisite	Signals and Systems
Course/ Paper	
Text Book	M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 3rd Edition.
Reference Books	1. I.J. Nagrath and M.Gopal, "Control System Engineering", Wiley Eastern, Second edition, 1982. 2. K.Ogata, "Modern control Engineering", Prentice Hall of India, 1989.

3. William A. Wolovich, “Automatic Control Systems-Basic Analysis and design”, Oxford, 2011.

4. Kuo, “Digital Control Systems”, Oxford, Reprint 2013.

Course Outcome

CO1. Thorough understanding of Control system and its classification, Ability to determine transfer function of system using Block Diagram Reduction technique and derive mathematical models of mechanical control system.

CO2. Ability to determine transfer function of system using Signal Flow Graph technique, capability to define stability conditions of system using Routh Hurwitz Criteria.

CO3. Ability to perform time response analysis of first order and second order LTI systems for various inputs and to perform frequency response analysis of LTI system using Root Locus, Bode Plot and Nyquist Plot.

CO4. Understanding of various types of Compensation techniques in control system, Ability to perform state space analysis of LTI system and compute Controllability and Observability of LTI system.

CO5. Understanding of Digital and Microprocessor based control systems and their stability criteria.

DIGITAL CIRCUITS AND SYSTEMS

Paper Code	**ECS-504**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT- I Electronic Devices** Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, LED, photo diode and solar cell. **UNIT- II MOS Transistor** Metal Oxide Semiconductor (MOS) Structure, MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitances. **UNIT-III MOS Inverters: Static and Switching Characteristics** Resistive-Load Inverter, Inverters with n-type MOSFET Load, CMOS Inverter; Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters **UNIT–IV MOS Logic Circuits and Semiconductor Memories** MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates); Latch and Flip-Flop Circuits, Static Random-Access Memory (SRAM) Circuits, Dynamic Random-Access Memory (DRAM) Circuits, Nonvolatile Memories. **UNIT–V Low-Power CMOS Logic Circuits** Need of Low power, Sources of Power Dissipation, Low-Power Design through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switching Capacitance.
Pre-Requisite	None
Text / Reference book	1. Donald A. Neamen, “Semiconductor Physics and Devices: *Basics Principles*”, 3rd Edition, Tata McGraw-Hill, 2002.

2. Sung Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits: *Analysis and Design*”, 3rd Edition, Tata McGraw-Hill, 2003.

Course Outcome

CO1: A thorough understanding of carrier transport in the semiconductor devices, and the working principle of basic semiconductor devices, such as diode, Zenor diode, BJT, LED, Photo detector, and Solar Cell etc.

CO2: An ability to explain the Operation and Scaling/Small-Geometry Effects of MOS Transistor (MOSFET).

CO3: A thorough understanding of the MOS Inverter Static and Switching Characteristics and to utilize basic understanding of the same to design complex MOS Logic Circuits.

CO4: An ability to design Complex MOS Logic Circuits and state of the Art Semiconductor Memories.

CO5: A thorough understanding of sources of power dissipation and their reduction of the same to design low power system.

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

VI SEMESTER

Microprocessors

Paper Code **ECS-601**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I INTRODUCTION AND ORGANIZATION

Evaluation of microprocessors, basic block of microcomputer, typical micro computer architecture, single chip microprocessor, functional representation of simple and typical microprocessor, general purpose and dedicated registers, INTEL 8085 pin and functional block diagram, tristate concept, INTEL 8085 externally initiated signals, basic concepts of timing and control unit.

UNIT-II PROGRAMMING OF MICROPROCESSORS

Data representation, instruction and data flow, addressing modes, instruction set of INTEL 8085 machine cycle, T-state and timing diagram, introduction to programming, use of mnemonics and assembly language, flowchart, assembler pseudo-instruction, flowchart and program writing techniques.

UNIT-III INTERFACING MEMORY AND I/O DEVICES

Necessity of interfacing, address space partitioning, and memory mapped I/O and I/O mapped I/O, hardware scheme of data transfer, various interrupt schemes and associated instructions of INTEL 8085, direct memory access data transfer. Review of semiconductor memories, timing operation, memory interfacing, programmable peripheral interfaces, and 8255, 8253 programmable interrupt controller, enabling and disabling and masking of interrupts, particularly in 8085.

UNIT-IV 16-BIT MICROPROCESSOR AND ITS ARCHITECTURE

Intel 8086/8088 architecture, addressing modes, instructions set, assembler dependent instructions, 8086 I/O, I/O processor (IOP), Interrupts and DMA .

UNIT-V PENTIUM AND PENTIUM PRO MICROPROCESSOR

Serial I/O, Introduction to Pentium and Pentium pro microprocessor, special pentium registers.

Pre-requisite Course/Paper: Computer Architecture

Text Book:

1. R. Goankar, “Microprocessor architecture”, Penram International Publication, Fifth edition, 1989

2. Rafiquzzaman, “Microprocessor and Microcomputer based System Design”, CRC press, 1995

Reference Books: B. B. Bray, “8086/8088/Intel Microprocessor”, 8th Edition

Course Outcomes

CO1: Familiarity with the basic architecture of a well-known microprocessor 8085, awareness of the instruction set and instruction execution mechanism in 8085 microprocessor**.**

CO2: An ability to learn the programming of 8085 microprocessor and its applications.

CO3: Achieving the thorough knowledge of data transfer between the microprocessor and the peripherals, challenges in data transfer and the limitations of basic architecture regarding the data transfer.

CO4: Learning how and why the microprocessor needs to be interrupted, how the software and hardware governs the interrupt process. The students will be introduced to high end processors.

CO5: To know the challenges and architectural limitations of 8085, 8086/8088 microprocessors. To know how these challenges have been overcome in high end processors like Pentium processors.

Computer usage/ Software required:
1. Assembly Language Programming
2. Microprogramming

DIGITAL SIGNAL PROCESSING

Paper Code **ECS-602**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I DISCRETE TIME SIGNALS AND SYSTEMS

Review of Discrete Time Fourier Transform, Z-transform, Properties of Z-transform, Discrete Time convolution, Difference equations, Direct Form I and II structures and stability analysis using Z-Transform.

UNIT- II DISCRETE FOURIER TRANSFORM

Introduction, The DFT: Fourier representation of periodic signals, properties of DFT: Linearity, Periodicity, Circular shift of a sequence, circular convolution and multiplication of two DFTs, Fast Fourier Transform (FFT) Algorithms: Decimation in Time and Decimation in Frequency domain.

UNIT- III INFINITE IMPULSE RESPONSE DIGITAL FILTER DESIGN

Introduction to III filters, Design of IIIR filters, Bilinear Transformation, Impulse Invariant Response method and Step-Invariant Response method. Digital filter transformation, Design examples.

UNIT-IV FINITE IMPULSE RESPONSE DIGITAL FILTER DESIGN

Introduction to FIRDF, Characteristics of FIR filters, Design of FIR filters: Fourier series and Window function method, Design examples

UNIT-V APPLICATIONS OF DSP

Introduction, Application to Image Processing: Image formation and recording, Image sampling and quantization, Image compression, Image restoration, Image enhancement. Application in RADAR. Application to Speech Processing: Model of Speech Production, Short time Fourier Transform and Synthesis of Speech, Speech Synthesis, Channel Vocoders, Subband coding of Speech and Audio signals: Transmitter, Receiver.

Pre-requisite Signals and Systems

Course/Paper:

Text Book: 1. J G Proakis and D G Manolakis, "Introduction to Digital Signal Processing", PHI,1989.

.**Reference Books:** 1. Andreas Antonio, "*Digital Filter Analysis, Design and Application*", McGraw Hill (International Edition), 1993

2. A V Oppenheim and R W Shafer, "*Digital Signal Processing*", PHI, 1985

3. L R Rabiner and B Gold, "*Theory and Application of Signal Processing*", PHI, 1985.

4. Roman Kuc, "*Introduction to Digital Signal Processing*", McGraw Hill Book Co, 1988.

Course Outcomes **CO1:** An ability to represent discrete time signals and their analysis using Z-transform

CO2: A thorough understanding of properties of DFT and algorithms of FFT

CO3: An understanding of the basic concept of IIR filters

CO4: An understanding of the basic concept of FIR filters and window functions

CO5: A familiarity with various applications of DSP

Computer usage/ MATLAB

Software required:

ANTENNA AND WAVE PROPAGATION

Paper Code **ECS-603**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT-I ELECTROMAGNETIC WAVES

Review of Maxwell's equations and boundary conditions. Wave equations and their solutions. Uniform plane waves, sinusoidal time variation, wave-propagation in lossless and conducting media, propagation in good dielectrics and conductors, depth of penetration, polarization, reflection and reflection co-efficient, reflection and refraction of planes waves by conductors and dielectrics, surface impedance.

UNIT-II GUIDED WAVES AND WAVEGUIDES

Guided wave propagation between parallel conducting planes, TE, TM and TEM modes of propagation, velocity of propagation, attenuation in parallel plane guides, rectangular plane guides: TE, TM and TEM modes of propagation, excitation of modes in waveguides. Introduction to cavity resonator. Introduction to cylindrical (metallic and dielectric) waveguides.

UNIT-III ANTENNA THEORY

Vector magnetic potential and retarded potentials. The alternating current element and its induction and radiation fields, power radiated by a current element, application to short and long antennae. Radiation resistance, directional properties of antennae, radiation patterns, Reciprocity theorem, equivalence of the receiving and transmitting patterns of an antenna. Directivity and gain, receiving cross-section, linear antenna arrays, broadcast arrays, effect of earth.

UNIT-IV ANTENNA SYSTEMS

Non-resonant antennae, Yagi-Uda and Rhombic antennae, UHF and microwave antenna: antenna with parabolic reflectors, horn and lens antenna, Turnstile and Clover leaf antenna, wideband and special purpose antennae: Helical discone, log-periodic and loop antennae.

UNIT-V RADIO WAVE PROPAGATION

Different ways of radio wave propagation, effects of environment on radio wave propagation. Ground (surface) waves and their characteristics, sky-wave propagation: the ionosphere and its effects, reflection mechanism, virtual height, critical frequency, maximum usable frequency, skip distance transmission path and fading, diversity techniques, Ionosphere variation,

space waves: microwave spacewave propagation, troposphere scatter propagation.

Pre-requisite Electromagnetic Field Theory

Course/Paper:

Text Book: Jordan E C & K G Balmain, “Electromagnetic Waves and Radiating Systems”, PHI Pvt. Ltd, New Delhi, 1987

Reference Books: J.D. Kraus, “Antenna and wave propagation”, Mc-Graw Hill, 4^{th} edition.

Course Outcomes

CO1: Knowledge of the concept of electromagnetic waves and its propagation in different mediums.

CO2: Analysis of bounded propagation of electromagnetic waves through waveguides & derive their characteristics.

CO3: Evaluation of infinitesimal current element as a dipole antenna and work-out its fields, power radiated and radiation pattern.

CO4: Knowledge of various types of antennas such Horn, Loop, Rhombic etc. And derive its various parameters for optimisation.

CO5: Analysing different types of radio wave propagation and atmospheric effects on radio wave propagation.

DATA COMMUNICATION AND COMPUTER NETWORKING

Paper Code **ECS-604**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I DATA COMMUNICATION AND NETWORKING

Data communication and networking; Communication model, Internet, OSI reference model, Concept and terminology: Analog and Digital data transmission, Transmission impairments, Channel capacity, Guided/Unguided transmission Media, Line Coding; Digital Modulation, Types of errors; Error Detection

UNIT- II DATA LINK CONTROL PROTOCOLS

Flow control, Stop and Wait Automatic Repeat Request (ARQ) Protocol, Go-Back-N ARQ Protocol, Selective Reject ARQ Protocol, Piggybacking, HDLC Protocol, HDLC frame format, Bit Stuffing

UNIT- III SWITCHING PRINCIPLES AND ROUTING PROTCOLS

Switched Communication networks, Circuit switching, Message switching and Packet switching principles, Datagram and virtual circuit switching, Routing in packet switched networks; Least cost Algorithms: Bellmann Ford Algorithm, Dijkstra Algorithm

UNIT-IV MEDIUM ACCESS CONTROL AND LOCAL AREA NETWORKS

Background; Topologies and Transmission Media; Random Access medium access control (MAC), LAN Protocol Architecture; Aloha and Slotted Aloha, Carrier Sensing Multiple Access/Collision Detection (CSMA/CD), Ethernet frame format, Bridges

UNIT-V INTERNET PROTOCOLS

TCP/IP protocol architecture, Internet protocols, IP addressing, IPv-4 and IPv-6, Address mapping, TCP and UDP, Electronic mail, SMTP, MIME and DNS

Pre-requisite Basic knowledge of computer and internet

Course/Paper:

Text Book: B.A. Forouzan , “Data Communication and Networking”, Tata McGraw Hill, India.

Reference Books:

1. William Stallings, Data and Computer Communications, Eighth Edition (2007), Pearson Education Low Price edition

2.D.E. Comer, “Computer Networks and Internets”, Pearson Education India.

Course Outcomes:

CO1: An understanding of the basic concept of data communication and computer networking.

CO2: A thorough understanding of the flow and error control protocols used in data transmission.

CO3: A understanding of the concept of switching and routing in switched network.

CO4: A thorough understanding of MAC layer and protocols related to it.

CO5: A familiarity with the concept of internet protocols and IP addressing.

Computer usage/ Software required:

Basic computer

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

VII SEMESTER

VLSI Design

Paper Code **ECS-701**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT-I MOSFET MODELS

Introduction, MOSFET modeling: accumulation, flat-band, depletion and inversion mode of operation, subthreshold conduction, Modeling Noise sources in MOSFET, Inverters, depletion load and enhancement mode MOSFET

UNIT-II DIGITAL VLSI DESIGN

NMOS device sizing, Device sizing in NOR and NAND gates, CMOS device sizing. Symmetric devices: Advantages and limitations, Transmission gates, signal propagation delay modeling**.**

UNIT-III CURRENT TRENDS IN VLSI DESIGN

Bulk Technology, Advantages and limitations, short channel effects: threshold voltage roll-off, channel length modulation, velocity saturation, DIBL, hot carrier effects, SOI Technology, Partially and fully depleted SOI, layout designing.

UNIT-IV CMOS PROCESSING TECHNOLOGY

Device fabrication, crystal growth, CZ technique, FZ technique, Oxidation, dry and wet oxidation, Lithography, Etching, Diffusion, Ion Implantation and Metallization.

UNIT-V PROGRAMMABLE DEVICES

Introduction to VHDL, design methodology, styles of modeling, designing basic building blocks and functional units as adder, multiplexer and decoder; programming the FPGA and CPLD.

Pre-requisite Course/Paper: Analog electronics –I & II, Digital circuits and Systems

Text Book:

1. Allen Strader, “VLSI Design technologies”, McGraw Hill International Edition, 1990.
2. May and Sze, “Semiconductor fabrication”, John Wiley, 2004.
3. Boris and Backer, “CMOS VLSI designing”, John Wiley, 3rd edition, 2001

Reference Books:

1. Neil H. E. Waste, “CMOS VLSI Design”, Pearson, 3rd edition, 2006.
2. R.J. Baker, H.W. Li and D.E. Boyce, “CMOS: Circuit Design, Layout and Simulation”, IEEE Press, PHI, Pvt. Ltd. New Delhi – 2000
3. R.L. Geiger, P.A. Allen and N.R. Strader, “VLSI: Design Techniques for analog Digital Circuits”, McGraw Hill International Edition, Electronic Engineering Series, 1990
4. S.M. Szee, “VLSI”, McGraw Hill International Editions, 2000
5. Malcolm R. Haskard, “ASIC Designing”, Printice Hall, New York, Edition, 1990
6. Donald L. Schilling and Charles Belove, “Electronic Circuits: Discrete and Integrated”, McGraw Hill Book Company, New Delhi

Course Outcomes

CO1: Understanding of basics of MOSFET modelling.

CO2: Understanding of impact of device sizing on the performance of Nano-scaled NMOS and CMOS circuitry.

CO3: Understanding of how to keep Moore’s law valid in future using bulk technology and SOI technology and the trade-off thereof.

CO4: Comprehensive knowledge of device fabrication, steps involved in integrated circuit fabrication, various challenges and the current solutions in IC fabrication

CO5: To implement combinational & sequential circuits using Hardware Descriptive Language (VHDL). To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA.

Computer usage/ Software required:

VHDL & Logic synthesis

WIRELESS COMMUNICATION

Paper Code	**ECS-702**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT- I WIRELESS PERSONAL AREA NETWORK (W PAN)

Introduction to Wireless Communication, radio frequency spectrum and unregulated bands, advantages and disadvantages of wireless communications; What is a WPAN, current standards – IEEE project 802; Infrared WPANs (IrDA) – overview, IrDA Overview, salient features and considerations; Bluetooth – introduction, Blue tooth SIG and IEEE 802.15.1 standards, Bluetooth protocol stack, Bluetooth radio module, Bluetooth power classes, Technology piconets and scatternets, Link management Protocol (LMP) Layer, Bluetooth security, Bluetooth issues.

UNIT- II WIRELESS LOCAL AREA NETWORKS (WLAN)

Introduction ; WLAN components – wireless NIC, Access points; WLAN Modes – Ad Hoc Mode, Infrastructure Mode; IEEE -802. standards; IEEE 802.11 Infrared WLAN; IEEE – 802.11b standards, Wi-Fi, Physical Layer, Medium Access Control Layer – put coordination function, association and re-association, power management, MAC frame-formats.

UNIT- III WIRELESS WIDE AREA NETWORKS (PART-I)

Introduction to mobile telephony, the conventional mobile telephone service – basis limitations; The concept of cellular telephony – how cellular telephony works; AMPS, digital cellular telephony; capacity augmentation techniques – frequency re-use, cell sectoring, cell splitting.

UNIT-IV WIRELESS WIDE AREA NETWORKS (PART-II)

Global System for Mobile – general GSM system structure, HLR, VIR, BSC, BTS, MSC; various generations of mobile networks (1a , 2G , 2.5G , 3G); Digital cellular wireless migration path; Satellite Communication –

introduction and basics , satellite system configuration , payload and platform , satellite frequency bands , modulation techniques – ASK , PSK , FSK , QAM ; frequency reuse : various types of satellites – LEO , MEO (HED), GEO (geosynchronous and geostationary)

UNIT-V FIXED WIRELESS

Introduction – What is fixed wireless? last mile wireless connection, baseband and broadband transmission, backhaul connections; Baseband systems – Remote Wireless Bridge; Broadband transmission – Free Space optics (FCD) salient features, advantages and disadvantages ; Local Multipoint distribution Service (LMDS), main features, LMDS infrastructures, advantage and disadvantages; Multichannel Multipoint Distribution Service (MMDS), main features, advantages, disadvantages.

Pre-requisite

Course/Paper: Communication Systems

Text Book/

- Mark Ciampa, “Guide to Wireless Communications”,

Reference books: Vikas Publishing House, Reprint 2003

- Theodore S. Rappaport, “Wireless Communications: Principles and Practices”, Pearson Education, 2nd edition.

Course

outcomes:

CO1: Ability to understand the fundamentals of wireless communication, Bluetooth and IrDA standards, their working and their comparison.

CO2: Ability to understand the IEEE 802.11 standards, their protocol description, power management and other issues, and the comparison of these standards.-Compare various wireless technologies

CO3: Ability to understand design of Wireless Wide Area Networks which includes the concept of cellular telephony, improving system capacity, handling interference, Radio Resource Management and handoff.

CO4: Ability to trace the evolution of various generations of mobile networks, including the evolution in technology (modulation type, etc) and transmission elements such as satellites.

CO5: Ability to understand the concept of fixed wireless in the backdrop of mobile networks, baseband and broadband technologies (FCD, LMDS, MMDS) and their comparison.

EMBEDDED SYSTEM DESIGN

Paper Code **ECS-703**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- 1

Definition, Characteristics of Embedded Systems, Design Challenge-optimizing design metrics, Performance of design metrics, Example of a Digital Camera chip.

UNIT- II

8051 Architecture, Programming model of 8051, Pin diagram of 8051,8051 oscillator and clock, Program counter and data pointer flags and Program status word (PSW), Internal memory, Internal RAM, Special function registers.

UNIT- III

Microcontroller Vs General Purpose Microprocessor, Microcontroller for embedded systems, X86PC embedded applications, 8051 Assembly language Programming, Assembling and Running 8051 program, Machine code in program, 8051 Flag bits and PSW, 8051 registers banks and stack, jump, loops, Logic and call instructions, Design from various 8051 chips, Delay Calculations.

UNIT-IV

I/O ports and programming, I/O bit manipulation program, 8051 programming in C, I/O programming in C, Addressing SFR, Logic operations in C, Data serialization 8051C.

UNIT-V

Connecting 8051 to 8255 motor control, Motor control: Stepper Motor interfacing, Controlling Stepper Motor via opt isolator

Pre-requisite

Course/Paper: Basic knowledge of digital logic required but not mandatory.

Text Book: Mohd. Ali Mazidi, JC Mazidi and Mc Kinlay, “The 8051 microcontroller and Embedded system- using Assembling and C”, Pearson 2008.

Reference Books: 1.Frank Vahid and Tony Givaris, “Embedded System”, Willy India 2002.

2. Rajkamal,“Embedded systems: architecture, programming and design”, Tata McGraw-hill 2008.

Course outcomes:

CO1: Thorough understanding of Embedded System and its characteristics, differences between Microprocessor and Microcontroller and optimization of Design Metrics for an Embedded System.

CO2: Understanding of architecture, Internal memory, Special function registers, Programming model and pin structure of 8051 microcontroller.

CO3: Thorough understanding of loop, jump, call instructions, various Addressing Modes, arithmetic and logic instructions in 8051, Ability to program 8051 in Assembly Language.

CO4: Ability to program 8051 microcontroller using Embedded C.

CO5: Capability to program 8051 timers to generate time delays and counter operations, understanding of 8051 interfacing with LCD, stepper motor and 8255 chip.

Computer usage: Assembly & C programming.

Software required:

DIGITAL COMMUNICATION

Paper Code	**ECS-704**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT – IANALOG-TO-DIGITAL CONVERSION (ADC) OF BASEBAND SIGNAL**

Pulse Code Modulation (PCM), Sampling, Quantization,Encoding, Quantization Noise and Signal-to-Quantization Noise Ratio (SQNR), Companders, Differential PCM (DPCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM).

UNIT- IIDIGITAL BASEBAND SIGNAL TRANSMISSION
Basic Building Blocks of Digital Communication systems.

Digital Signaling: Binary and M-ary Signals, PCM Formats, PAM and Orthogonal symbols, Gram-Schimdt Orthogonolization Procedure (GOP), Constellation Diagram.

PCM Formats/Line Codes: Unipolar, Polar, Bipolar, Dipolar (OOK and Antipodal), AMI and CMI Line Codes.

Bandwidthand Power of Line Codes: Power Spectral Density (PSD) of General Line Code, PSD and Bandwidth of various Line Codes.

Baseband Signal Transmission through Bandlimited Channels: Intersymbol Interference (ISI), Receiver Output in the Presence of ISI, Nyquist's First Criterion for Zero ISI: Ideal and Practical Solutions, Criterion for controlled ISI: Correlative Coding, Eye Pattern

UNIT III DIGITAL BANDPASS MODULATION
Types of Digital Bandpass Modulation, Mathematical Representation, Constellation Diagrams, Frequency Spectrum, Bandwidth and Generation of the following Digital Bandpass Modulation techniques:
Amplitude Shift Keying (ASK): Binary ASK (On-Off Keying), M-ary ASK
Phase Shift Keying (PSK): Binary PSK (BPSK), M-ary PSK (MPSK), Differential PSK (DPSK), Quadrature PSK (QPSK).
Frequency Shift Keying (FSK): Binary FSK (BFSK), M-ary FSK (MFSK), Continuous Phase FSK (CPFSK), Minimum Shift Keying (MSK), and Gaussian-filtered MSK (GMSK).

UNIT-IV : OPTIMUM RECEIVERS: DEMODULATORS AND DETECTORS OF DIGITAL SIGNALS IN AWGN

Optimum Demodulators: Matched Filter Demodulator, Properties of Matched Filter, Correlation-type Demodulator, Matched Filter and Correlation-type Optimum Demodulators for Binary and M-ary signals.
Optimum Detectors: Maximum *a posteriori* (MAP) Criterion, Maximum Likelihood (ML) Criterion.

UNIT-V SYNCHRONIZATION, DEMODULATION AND DETECTION OF DIGITAL BANDPASS MODULATED SIGNALS

Carrier Synchronization: M^{th} Power PLL
Symbol Synchronization: Early-Late Gate Synchronization.
Demodulation and Detection: Coherent &Non-Coherent Techniques
ASK: Coherent BASK, MASK
PSK: Coherent BPSK, MPSK, QPSK &Non-Coherent DPSK
FSK: Coherent & Non-Coherent MFSK, Optimum Detection of BFSK

Pre-requisite

Course/Paper: ECS-404 Communication Systems, Maths III

Text Book:

1. J G Proakis& Masoud Salehi, “Digital Communications”, Mc Graw Hill Education, 5th Edn., 2014.

2. SimonHaykin, “Digital Communications”, Wiley India Edition, 2006.

Reference Books:

1. B P Lathi &Zhi Ding, “Modern Digital & Analog Communication Systems”, Oxford University Press, 4th Edn., 2011.

2.. Leon W Couch II,” Digital & Analog Communication Systems”, Prentice Hall of India, 7th Edn., 2008

Course Outcomex:

CO1: To become familiar with Analog-to-Digital converters for baseband signal such as PCM, DPCM, DM and ADM.

CO2: A thorough understanding of digital signalling for the baseband signal transmission , line codes and applying various pulse-shaping techniques to combat the ISI present in the received signal.

CO3: To familiarize with different types of digital modulation schemes such as ASK, PSK, FSK and their different forms.

CO4: An ability to design demodulators and detectors for digital signal in the presence of AWGN.

CO5: A thorough understanding of synchronization demodulation and detection of digital bandpass modulated signals.

Computer usage/

Software required: MATLAB

ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH

VIII SEMESTER

MICROWAVE ENGINEERING

PaperCode: **ECS – 801**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description UNIT I ELECTROMAGNETIC WAVES

Microwave frequencies, system and unit of measure, review of Maxwell's equations and formation of electric and magnetic waves, equation in rectangular and cylindrical co-ordinates plane, uniform plane and non-uniform waves, reflections, boundary conditions plane wave propagation in free space, lossless, lossy media, good conductors, poor conductors, linear and circular polarization of electromagnetic waves.

UNIT II MICROWAVE TRANSMISSION LINES

Transmission line equation and their solutions, characteristic impedance, propagation constant standing waves and reflections. Measurement of standing waves ration and their interpretations. Quarter and half wave-length lines, circuit properties of transmission lines. Single stub and double stub for matching. Smith chart and application.

UNIT III WAVE GUIDES, CAVITY RESONATORS AND COMPONENTS

Introduction to wave guides, solution of wave equations for rectangular and circular wave guides, TE and TM modes in rectangular guides and their field configuration, Methods of excitation of wave guides, wave guide joints and their basic accessories. Rectangular and cavity resonators, field configuration and resonant frequency. Wave guides tees, magnetic tees, hybrid rings, directional coupler, circulation and isolators.

UNIT IV MICROWAVE TUBE AND CIRCUITS

Working principle of Klystron, reflex Klystron, Magnetron, traveling wave tubes. (TWTO). Formulation of expressions for velocity modulations, transit time of electron, beam coupling co-efficient, bunching parameters of Klystron and reflex Klystron, application process in magnetron and traveling wave tube (TWT). Formulation of expression of cut-off voltage and fluxing cylindrical magnetron.

UNIT V SOLID STATE MICROWAVE DEVICES AND CIRCUITS

Stripline and micro strip circuits, microwave transistors and integrated circuits and their high frequency limitations. Circuit properties and principle of working of Varactor, Laser, Laser parametric amplifier, tunnel diodes, gun devices. IMPATT, TRAPATS, BARITT and PIN diodes and their practical applications.

Pre-requisite

Course/Paper ELECTROMAGNETIC FIELD AND THEORY

Text Books Samuel Y. Lio, “Microwave Devices and circuits”, PHI Ltd.,

Reference Books

1. Electronics Comm. System by George Kennedy, McGraw Hill International Publication,2006.

2. M.Kulkarni,”Microwave And Radar Engineering”,Umesh Publications,2003.

3. K.D.Prasad, “Antenna and Wave Propagation”, Satya Prakashan New Delhi,2008.

Course Outcomes:

CO1: To understand and analyze various principles involving propagation of microwaves in different media.

CO2. To analyze how transmission lines can be utilized as circuit elements and to study different impedance matching techniques.

CO3: Ability to identify and study the performance of wave guides and resonators and to study the performance of various microwave components.

CO4: To study the comparative performance and analysis of microwave tubes and circuits.

CO5: To understand the significance, types and characteristics of various microwave solid state devices and circuits.

.

OPTICAL FIBER COMMUNICATION

Paper Code: **ECS-802**

Course Credits: 4

Lectures/ Week: 3

Tutorials/ Week: 1

Course description: **UNIT I: INTRODUCTION**

Introduction, Elements of Optical fiber link, Ray theory transmission; Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Mode theory of optical propagation; Electromagnetic waves, Maxwell equations, Modes in Planar guide, Fiber types; Single mode fibers, Multimode fibers, Step index fibers, Graded index fibers.

UNIT II: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

Attenuation; Absorption losses, intrinsic absorption, extrinsic absorption, Linear and Non linear Scattering losses, Rayleigh scattering, Mie Scattering, Dispersion; Intra and inter Modal Dispersion, Multipath dispersion, Chromatic dispersion, waveguide dispersion, Over all Fiber Dispersion.

UNIT III: SOURCES AND DETECTORS

Optical sources: Light Emitting Diodes (LED), Laser diode(LD); Absorption and Emission of radiation, Spontaneous emission and stimulated emission, Population inversion, Comparison of LED and LD, Optical Detectors; Photo diode, PIN photodiode, Avalanche photodiode(APD), Responsively, Quantum efficiency , Photo detector noise –Noise sources , Signal to Noise ratio , Detector response time, Optical modulators.

UNIT IV: FIBER LINK DESIGNAND OPTICAL MODULATORS

Fiber Link : System design considerations, Link Design, Link Loss Budget - Power Budget and Time Budget, Loss limits, Dispersion limits, Bandwidth

distance product, Modulation of LED and LD, Mach- Zehnder Modulator(MZM), Electro-Absorption Modulator(EAM)

UNIT V: COHERENT LIGHT WAVE SYSTEMS AND OPTICAL NETWORKS

Basic concepts; Local oscillator, Homodyne and Heterodyne detection/demodulation, Signal to noise ratio, Modulation formats; ASK Format, PSK Format, FSK Format, Bit Error Rate, Networks – SONET / SDH, WDM Networks ; Conventional WDM, Course WDM, Dense WDM, EDFA system

Text Book:

1. Optical Fiber Communications Principles and Practice – John M. Senior, Pearson Education – Third Edition. 2009.

2. Optical Fiber Communications – Gerd Keiser – Mc Graw Hill – Fifth Edition. 2013

3. Fiber-optic communication systems - Govind P. Agrawal, Third edition, John Wiley & sons, 2002.

Course Outcomes:

CO1. An ability to understand the general system of optical fiber communication, ray & mode theory and fiber configuration.

CO2. An ability to explain the attenuation, scattering, & bending loss and dispersion of fiber.

CO3. An ability to describe optical sources like LEDs, Laser diodes and Optical detectors like photodiode, PIN photodiode, Avalanche photodiode (APD).

CO4. An ability to analyze and apply link design and understand Mach-Zehnder Modulator (MZM), Electro-Absorption Modulator (EAM) and EDFA system.

CO5. An ability to describe fundamental receiver operation, SONET/SDH and WDM concept.