

Department of Electronics and Communication Engineering  
Jamia Millia Islamia  
**B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE**  
UNDER THE CHOICE BASE CREDIT SYSTEM (CBCS)  
Effective from July 2016

**Codes for nature of courses**  
L: Lecture courses  
P: Laboratory Based courses  
SEC: Skill Enhancement Courses  
S: Seminar/ Independent Study

**Category of Courses**  
DC: Departmental courses  
CBCS: Choice based Credit System  
AECC: Ability Enhancement Compulsory Course

**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**

S.No	Third Semester										Total Marks	
	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
					L	T	P	Mid Semester Evaluation		End Semester Evaluation		
							CC A	M SE -1	M S E-2			
01	AS-301	Engineering Mathematics	DC	4	3	1	-	10	15	15	60	100
02	ECS-302	Analog Electronics-I	DC	4	3	1	-	10	15	15	60	100
03	ECS-303	Circuit Analysis and Synthesis	AEC C	4	3	1	-	10	15	15	60	100
04	ECS-304	Electronic Measurements and Instrumentation	DC	4	3	1	-	10	15	15	60	100
05	ECS-305	Logic Design	CBCS	4	3	1	-	10	15	15	60	100
<b>PRACTICAL (LAB.)</b>												
06	ECS-310	Analog Electronics-I	DC	2	-	-	4	10	10	10	20	50
07	ECS-311	Circuit Simulation Lab	DC	2	-	-	4	10	10	10	20	50
	ECS-312	Logic Design	SEC	2	-	-	4	10	10	10	20	50
<b>Total</b>				<b>26</b>							<b>650</b>	
Fourth Semester												
01	ECS-401	Analog Electronics-II	DC	4	3	1	-	10	15	15	60	100
02	ECS-402	Signals and Systems	AEC C	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	DC	4	3	1	-	10	15	15	60	100
05	ECS-405	DSCP	SEC	4	3	1	-	10	15	15	60	100
<b>PRACTICAL (LAB.)</b>												
06	ECS-410	Analog Electronics-II	SEC	2	-	-	4	10	10	10	20	50
07	ECS-411	Communication Engg.	DC	2	-	-	4	10	10	10	20	50
<b>Total</b>				<b>24</b>							<b>Total 600</b>	

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**B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING -III YEAR**

Fifth Semester												
No	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
					L	T	P	Mid Semester Evaluation			End Semester Evaluation	Total Marks
								CCA	MSE-1	MSE-2		
01	ECS-501	Active Filters and Signal Processing	AEC C	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	DC	4	3	1	-	10	15	15	60	100
04	ECS-504	Digital Circuits and Systems	DC	4	3	1	-	10	15	15	60	100
<b>PRACTICAL (LAB.)</b>												
06	ECS-510	AFSP Lab	DC	2	-	-	4	10	10	10	20	50
07	ECS-511	Instrumentation Lab	SEC	2	-	-	4	10	10	10	20	50
08	ECS-512	Digital Circuits Lab	DC	2	-	-	4	10	10	10	20	50
<b>Total</b>				<b>22</b>								<b>550</b>
Sixth Semester												
01	ECS-601	Microprocessor	CBCS	4	3	1	-	10	15	15	60	100
02	ECS-602	Digital Signal Processing	DC	4	3	1	-	10	15	15	60	100
03	ECS-603	Antenna and Wave Propagation	DC	4	3	1	-	10	15	15	60	100
04	ECS-604	Data Communication and Computer Networking	DC	4	3	1	-	10	15	15	60	100
<b>PRACTICAL (LAB/SEMINAR)</b>												
06	ECS-610	Microprocessor Lab	DC	2	-	-	4	10	10	10	20	50
07	ECS-611	DSP Lab	SEC	2	-	-	4	10	10	10	20	50
08	ECS-612	Seminar	DC	2	-	-	4	10	10	10	20	50
<b>Total</b>				<b>22</b>								<b>Total 550</b>



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S: Seminar/ Independent Study

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**B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING -IV YEAR**

S.No	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				Total Marks	
					L	T	P	Mid Semester Evaluation			End Semester Evaluation		
								CC A	MSE -1	MSE -2			
01	ECS-701	VLSI Design	AEC C	4 3	1	-		10	15	15	60	100	
02	ECS-702	Wireless Communication	DC	4 3	1	-		10	15	15	60	100	
03	ECS-703	Communication Networks	CBCS	4 3	1	-		10	15	15	60	100	
04	ECS-704	Digital Communication	DC	4 3	1	-		10	15	15	60	100	
<b>PRACTICAL (LAB./MINOR PROJECT)</b>													
05	ECS-711	VLSI Lab	DC	2	-	-	4	10	10	10	20	50	
06	ECS-712	Minor Project	SEC	6	-	-	12	30	30	30	60	150	
<b>Total</b>				<b>24</b>								<b>600</b>	
<b>Eighth Semester</b>													
01	ECS-801	Embedded Systems	CBCS	4 3	1	-		10	15	15	60	100	
02	ECS-802	Microwave Engineering	DC	4 3	1	-		10	15	15	60	100	
03	ECS-803	Optical Fiber Communication	DC	4 3	1	-		10	15	15	60	100	
<b>PRACTICAL (LAB./MAJOR PROJECT)</b>													
05	ECS-811	Microwave Engineering Lab	SEC	2	-	-	4	10	10	10	20	50	
06	ECS-812	Major Project	DC	8	-	-	16	40	40	40	80	200	
<b>Total</b>				<b>22</b>								<b>Total</b>	<b>550</b>

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**M. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING-I YEAR**

First Semester													
No	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)					
					L	T	P	Mid Semester Evaluation			End Semester Evaluation	Total Marks	
								CCA	MSE-1	MSE-2			
01	MEC-101	Random Variables & Stochastic Processes	CBCS	4	3	1	0	10	15	15	60	100	
02	MEC-102	Low Power VLSI Design	DC	4	3	1	0	10	15	15	60	100	
03	MEC-103	Telecommunication Switching & Networks	AEC	4	3	1	0	10	15	15	60	100	
04	Elective-I	Elective - I	DC	4	3	1	0	10	15	15	60	100	
<b>PRACTICAL (LAB.)</b>													
05	MEC-151	Advanced VLSI Lab	SEC	2	0	0	2	30	0	0	20	50	
06	MEC-152	Advanced Communication Systems Lab	DC	2	0	0	2	30	0	0	20	50	
<b>Total</b>				<b>20</b>								<b>500</b>	
Second Semester													
01	MEC-201	3G/4G Networks & Convergence	DC	4	3	1	0	10	15	15	60	100	
02	MEC-202	Advanced Digital Signal Processing	CBCS	4	3	1	0	10	15	15	60	100	
03	MEC-203	Modern Instrumentation & Sensors	DC	4	3	1	0	10	15	15	60	100	
04	Elective-II	Elective - II	DC	4	3	1	0	10	15	15	60	100	
<b>PRACTICAL (LAB.)</b>													
05	MEC-251	Microwave & Optical Communication Lab	SEC	2	0	0	2	30	0	0	20	50	
06	MEC-252	Digital Signal Processing Lab	DC	2	0	0	2	30	0	0	20	50	
<b>Total</b>				<b>20</b>								<b>Total</b>	<b>500</b>



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**M. 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)				Total Marks
					L	T	P	Mid Semester Evaluation			End Semester Evaluation	
								CCA	MSE-1	MS E-2		
01	MEC-301	Advanced Signal Processing	CBCS	4	3	1	0	10	15	15	60	100
02	Elective-III	Elective – III	DC	4	3	1	0	10	15	15	60	100
<b>PRACTICAL (LAB/MINOR PROJECT)</b>												
03	MEC-351	Seminar	SEC	6	-	-	6	90	0	0	60	150
04	MEC-352	Minor Project	DC	10	-	-	10	150	0	0	100	250
<b>Total</b>				<b>24</b>								<b>600</b>
Fourth Semester												
01	MEC-401	Dissertation	DC	16	0	0	16	240	0	0	160	400
<b>Total</b>				<b>16</b>								<b>400</b>

**Elective – I**

MEC-104 Modern Digital Communication Systems  
MEC-105 Information Theory and Coding  
MEC-106 Nanoelectronics & Devices

**Elective – II**

MEC-204 Advanced Computer Networks  
MEC-205 FPGA Based System Design  
MEC-206 Secure Communication

**Elective – III**

MEC-302 Digital Image Processing  
MEC-303 Advanced Optical Communication  
MEC-304 Advanced Embedded Systems

## VLSI Design

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**Paper Code** ECS-702

**Course Credits** 5

**Lectures/ Week** 4

**Tutorials/ Week** 1

**Course description**

**UNIT-I FUNDAMENTALS**  
Introduction, Size and complexity of Integrated Circuits, IC Design process, trends in VLSI Design, VLSI layout, C-MOS IC Design process, Device modeling (Analog MOSFET models and Digital MOSFET models), circuit simulation.

**UNIT-II C-MOS DIGITAL CIRCUITS**  
The basic inverter, dc characteristics, switching characteristics, layout of inverter, device sizing, C-MOS logic gates, transmission gates, capacitive loading considerations, power dissipation, noise in digital logic circuits, BI-CMOS logic gates.

**UNIT-III STRUCTURES DIGITAL CIRCUITS AND SYSTEMS**  
Introduction, random logic versus structured logic forms, structured gate layout, logic gate arrays, MOS clocking schemes, dynamic MOS storage circuits, clock C-MOS logic, design Automation.

**UNIT-IV DESIGN AUTOMATION**  
Introduction, Si Wafer preparation, mask making, Lithography, typical C-MOS circuit, Wafer probe, separation packaging, Process Yield, Process Spreads (variations), Temperature and Voltage effects, Scaling Laws, Latch up.

**UNIT-V CURRENT TOPIC IN VLSI DESIGN**  
Introduction, ASIC Design, custom designing, semicustom designing, standard cell designing, Silicon compilers (Bristle blocks Si Compiler, Macpitts Si Compiler and Commercial Si Compilers), Cost analysis Design for testability, Clocks, VHDL Design Methodology and System Design Consideration.

**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, 3<sup>rd</sup> edition, 2001

**Reference Books:**

1. Neil H. E. Waste, "CMOS VLSI Design", Pearson, 3<sup>rd</sup> 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 Objective:**

- To learn VLSI Designing from algorithm to silicon.
- To learn CMOS designing.
- To learn layout designing.
- To learn fabrication of devices from crystal growth to packaging.

**Course learning / outcome:**

- Students learn basics of all technologies.
- They became well versed with NMOS and CMOS VLSI Designing.
- They learn front end and back end VLSI designing.
- They get exposed to layout designing and learn various design rules.
- They learn VHDL/Verilog, which is used for front end designing.
- They learn almost everything about fabrication of a chip from crystal grown to metallization.

**Computer usage/**

VHDL & Logic synthesis

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Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of VLSI System Design such as Intel, IBM, Synopsys, Silvaco, Cadence etc.

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## **WIRELESS COMMUNICATION**

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<b>Paper Code</b>	<b>ECS-703</b>
<b>Course Credits</b>	5
<b>Lectures/ Week</b>	4
<b>Tutorials/ Week</b>	1
<b>Course description</b>	<b>UNIT- I      WIRELESS PERSONAL AREA NETWORK (W PAN)</b>

**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 (FSD) 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, 2<sup>nd</sup> edition.

**Course Objective:**

- To provide a broad survey of wireless communications including in-depth coverage of protocols, transmission methods and IEEE 802.11 standards
- To learn the wireless technologies used in personal area networks, local area networks, cell phones, and wide area

networks including coverage of wireless LANs, fixed broad band wireless, and digital cellular telephony

**Course learning  
outcome:**

Upon successful completion of the course, students should be able to:

- Understand the fundamentals of wireless communication
- Compare various wireless technologies
- Understand the protocols and IEEE 802.11 standards, Bluetooth and IrDA standards
- Understand the wireless personal area networks, wireless Local area networks and wireless wide area networks
- Understand fixed broad band wireless networks and digital cellular telephony

Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of Mobile Communication, Wireless Signal Processing, and in general Wireless System Design, the company and/or R/D centers includes Reliance Communication, Airtel, BSNL & MTNL etc.

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## **EMBEDDED SYSTEM DESIGN**

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**Paper Code**                      **ECS-704**

**Course Credits**                **5**

**Lectures/ Week**                **4**

**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", Wiley India 2002.
2. Rajkamal, "Embedded systems: architecture, programming and design", Tata McGraw-hill 2008.

### **Course Objective:**

-The main aim of the course is to provide the student with a detailed understanding of embedded systems design using 8051 microcontroller.

-To learn the fundamental of embedded system design, challenges and performance metrics.

-In depth understanding of the architecture and instruction set of the 8051 microcontroller.

-To establish a foundation of Assembly Language Programming.



-To impart the necessary knowledge for hardware implementations with the view that students will be able to apply the concepts to the real world problems.

**Course learning**

Upon course completion, students should be able to

**outcome:**

- Optimize the design metrics.
- Program microcontroller using assembly language and C-programming.
- Interface a microcontroller system with different peripheral device.
- Produce an efficient code for embedded systems.
- Design, test and critically evaluate embedded solutions to real world problems.

**Computer usage:**

Assembly & C programming.

**Software required:**

Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of VLSI System Design, the company such as Intel, IBM, Synopsys, Silvaco, Cadence etc.

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## MICROWAVE ENGINEERING

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**Paper Code:** ECS – 801

**Course Credits** 5

**Lectures/ Week** 4

**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 objective:**

-An introduction to microwave engineering which includes Transmission lines as circuit elements, Smith chart analysis methods, Impedance transforming and matching circuits

- To understand the theoretical principles underlying microwave devices and networks.
- To understand Microwave devices, components, their characteristics, their working, and their applications.
- Study the operation and working of the various tubes or sources for the transmission of the microwave frequencies.
- Study the various parameters and characteristics of the various waveguide components.

**Course Learning**

After completion of the course, students will be able to:

**Outcome:**

- Analyze the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
- Analyze the operation and working of the various tubes or sources for the transmission of the microwave frequencies.
- Know the significance, types and characteristics of the slow wave structures used for the transmission of the microwave frequencies.
- Know about the significance, types and characteristics of microwave solid state devices.
- Acquire knowledge about the measurements to be done at microwaves.
- Acquire complete knowledge about the applications of the microwaves for today generation.

Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of RF and Microwave System Design, the company such as DRDO, ISRO, Intel, IBM etc.

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**OPTICAL FIBER COMMUNICATION**

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<b>Paper Code:</b>	<b>ECS-802</b>
<b>Course Credits:</b>	5
<b>Lectures/ Week:</b>	4
<b>Tutorials/ Week:</b>	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 Nonlinear 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), Responsivity, Quantum efficiency , Photo detector noise –Noise sources , Signal to Noise ratio , Detector response time, Optical modulators.

## **UNIT IV: FIBER LINK DESIGN AND 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 Objective:**

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To learn the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
- To learn the various optical sources and detectors
- To learn the system design aspects of fiber link and direct and indirect optical modulation
- To develop understanding of homodyne and heterodyne demodulation techniques and to learn optical networks

**Course Learning**

**Outcomes:**

- Understand the fundamentals of optical fiber communication.
  - Understand the different losses and signal distortion in fiber
  - Compare the optical sources and detectors and understanding selection criteria as per application.
  - Compute loss budget and rise time budget for fiber link design
  - Understand direct and indirect optical modulators and optical amplifiers (EDFA).
  - Understand homodyne and heterodyne demodulation techniques
  - Understand the fundamental of optical networks (SONET) and WDM
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Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company dealing with optical fiber and optical sources manufacturing, the company and/or R/D centers such as KEI Industries Limited, Sterlite Technologies Limited, Birla Cable Limited, DRDO, ISRO etc.

**MEC-102 Low Power VLSI Design**

**LTP 310 Credit-4**

**Motivation for low power designing:**

**Source of power dissipation:** Static power dissipation; Dynamic power dissipation; switching power dissipation.

**Power estimation:** introduction; Probabilistic technique; Statistical technique; Estimation of glitching power; Power estimation at the circuit level; High level power estimation; Information theory based approaches.

**Synthesis for low power:** Behavioral level transforms; Logic level optimization; Circuit level; Low voltage CMOS circuits;

**Software design for low power:** Introduction; Sources of software power dissipation; Software power estimation; software power optimizations.

Text/References

1. Y. Taur and T.H. Ning, Fundamentals of Modern VLSI Devices. New York: Cambridge Univ. Press, 1998, ch.2, pp. 97-99.
2. K. Roy and S.C. Prasad Low Power CMOS VLSI Circuit Design. New York: Wiley, 2000, ch.2, pp. 82-29.
3. J.M. Rabaey, Digital Integrated Circuits, Englewood Cliffs, NJ: Prentice-Hall, 1996, ch.2, pp. 55-56.
4. M.C. Johnson and K. Roy, "Software design for low power".

Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of VLSI System Design such as Intel, IBM, Synopsys, Silvaco, Cadence etc.

### **3G/4G Networks and Convergence**

**Paper code**

**MEC-201**

**Course description Unit: 1**

1G,AMPS ,2G,GSM,IS-54, IS-136, IS-95,2G-Cordless Telephone,3G System, WCDMA, HSDPA,HSUPA ,CDMA-2000, EDGE/UWC-136,

**Unit: 2**

GSM Services: Bearer Services, Tele services, Supplementary Services GSM System Architecture and Interface, MS, BSS, NSS, OSS, GSM Interface Standard, GSM Network Architecture.

**Unit: 3**

Basic of GSM Air Interface/Radio link: Multiple Access, Frequency Hopping, Channel Type and Channel modes, Burst Formatting and Frame Hierarchy, Channel Codes, Mode of Voice Transmission, Discontinuous Reception (DRX) Power Control, GSM Evolution, IS-95 System Architecture, IS-95 Interface, IS -95 Functional model, "Communication Control plane" and "Radio Resource Control Plane"



using IN concept.

#### **Unit: 4**

CDMA: Basic of CDMA, Fundamental of CDMA, Correlation Properties of Random CDMA Spreading Sequences, CDMA advantage and RAKE receiver Multi-User CDMA, Multi user CDMA downlink , multi user uplink and Asynchronous CDMA, CDMA near far problem.

#### **Unit: 5**

GPRS, General Architecture, GPRS network elements: Serving GPRS Support node (SGSN), Gateway GPRS support node (GGSN), Charging gateway (CG), Lawful interception Gateway (LIG), Domain Name System ( DNS), GPRS Air Interface and Resource sharing with GSM, EDGE, Evolution of mobile communication system.

**COURSE OUTLINE** This course is intended as an introductory course for Postgraduate Students in the areas of Communications and Signal Processing. Students who would like to specialize in this area will also find this course revealing.

**PREREQUISITES**

1. An undergraduate course in Communication Theory.
2. An undergraduate course in Mobile or Wireless Communications.

**REFERENCES**

1. Wireless Communications: Andrea Goldsmith, Cambridge University Press.
2. Wireless Communications: Principles and Practice by Theodore Rappaport, Prentice Hall.

#### **Course Outcomes:**

**CO1:** Unit 1 provides a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. Building on the prior knowledge on digital communications, students develop further understanding on the challenges and opportunities

brought by the wireless medium in designing current and future wireless communication systems and networks.

**CO2:** Unit 2 provides a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems.

**CO3:** An in-depth understanding of the wireless channel and the related impairments

**CO4:** Understand the fundamental of CDMA and various issues related to code division multiple access.

**CO5:** Comprehensive overview of GPRS and detailed understanding of GPRS

Employability/ Entrepreneurship/ Skill development: After attending this course students will be ready to be employed/hired by company working in the field of Mobile Communication, Wireless Signal Processing, and in general Wireless System Design, the company such as Hughes Communications India Ltd, Reliance Communication Ltd., BSNL , MTNL etc.

**ELECTRONICS &  
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**M. TECH  
I SEMESTER**



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## RANDOM VARIABLES AND STOCHASTIC PROCESSES

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**Paper Code**                      **MEC-101**

**Course Credits**                4

**Lectures/ Week**               3

**Tutorials/ Week**               1

**Course description**            **UNIT - I TWO RANDOM VARIABLES**

Bivariate Distributions, One Function of Two Variables, Two functions of two variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values

**UNIT - II SEQUENCE OF RANDOM VARIABLES**

General Concept, Conditional Densities, Characteristic Functions And Normality, Mean Square Estimation, Stochastic Convergence and Limit Theorems, Random Numbers: Meaning and Generation

**UNIT - III GENERAL CONCEPTS OF STOCHASTIC PROCESS**

Definitions, Statistics of Stochastic Processes, Correlation and Covariance, Stationary Processes: Strict Sense Stationary and Wide Sense Stationary, Systems with Stochastic Input, Power Spectrum, Discrete-Time Processes

**UNIT - IV APPLICATION OF STOCHASTIC PROCESSES**

Modulation, Bandpass Processes, Frequency Modulation, Cyclostationary Processes, Band Limited Processes and Sampling Theorem, Deterministic Signals in Noise: Matched Filter Principle, White Noise, Colored Noise, Tapped Delay Line

**UNIT - V MEAN SQUARE ESTIMATION (MSE)**

Introduction of MSE, Prediction, Filtering and Prediction, Kalman Filters

**Text Book:**

1. "Probability, Random Variables and Stochastic Process" by Athanasios Papouplis & S. Unnikrishna Pillai 4<sup>th</sup> Edition, 2002, McGraw Hill Education(India) Private Limited, New Delhi

**Reference Books:**

1. "Probability, Random Variables and Random Signal Principles" by Peyton Z. Peebles Jr., 4<sup>th</sup> Edition, 2002, McGraw Hill Education(India) Private Limited, New Delhi  
2. "Probability And Random Variables with Applications to Signal Processing" by Henry Stark & John W. Woods, 3<sup>rd</sup> Edition 2002, Pearson education, Delhi

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## LOW POWER VLSI DESIGNING

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<b>Paper Code</b>	<b>MEC-102</b>
<b>Course Credits</b>	4
<b>Lectures/ Week</b>	3
<b>Tutorials/ Week</b>	1
<b>Course description</b>	<p><b>UNIT - I MOTIVATION FOR LOW POWER DESIGNING AND SOURCES OF POWER IN CMOS</b> Why low power, advantages and applications, Static power dissipation; Dynamic power dissipation; switching power dissipation. Reduction techniques for dynamic and switching power.</p> <p><b>UNIT - II LEAKAGE POWER IN NANOSCALED DEVICES:</b> Sources of leakage power, leakage components, short channel effects, drain induced barrier lowering, charge sharing, punch-through, gate tunneling, GIDL, subthreshold conduction. Reduction techniques of leakage power at the device and circuit levels.</p> <p><b>UNIT - III POWER ESTIMATION: INTRODUCTION</b> Probabilistic technique; Statistical technique; Estimation of glitching power; Power estimation at the circuit level; High level power estimation; Information theory based approaches.</p> <p><b>UNIT - IV SYNTHESIS FOR LOW POWER:</b> Behavioral level transforms; Logic level optimization; Circuit level; Low voltage CMOS circuits.</p> <p><b>UNIT - V SOFTWARE DESIGN FOR LOW POWER:</b> Introduction; Sources of software power dissipation; Software power estimation; software power optimizations.</p>
<b>Prerequisites:</b>	Digital designing, Computer architecture

## **Text/References**

1. Y. Taur and T.H. Ning, Fundamentals of Modern VLSI Devices. New York: Cambridge Univ. Press, 1998, ch.2, pp. 97-99.
2. K. Roy and S.C. Prasad Low Power CMOS VLSI Circuit Design. New York: Wiley, 2000, ch.2, pp. 82-29.
3. J.M. Rabaey, Digital Integrated Circuits, Englewood Cliffs, NJ: Prentice-Hall, 1996, ch.2, pp. 55-56.
4. M.C. Johnson and K. Roy, "Software design for low power".

## **Course Outcomes**

**CO1:** Motivation and importance of low power VLSI Designing. Awareness of different sources of power.

**CO2:** Learning various components of leakage power, their sources and the ways to reduce them. .

**CO3:** Achieving the thorough knowledge of power estimation at various design abstraction levels.

**CO4:** Learning about the synthesis for low power designing, ways, importance and applications.

**CO5:** Learning various sources of power in software and their reduction techniques.

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## **TELECOMMUNICATION SWITCHING AND NETWORKS**

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**Paper Code**                      **MEC-103**

**Course Credits**                4

**Lectures/ Week**               3

**Tutorials/ Week**               1

**Course description**            **UNIT- I TELEPHONE NETWORKS**

Introduction, Evolution of telecommunications, classification of switching systems, Step by step switching, Trunking diagram of 1000 line switching system, 10000 switching system, Electronic Exchange, Subscriber loop systems, length and attenuation limitation of subscriber loop, Unigauge subscriber loop, Loading Coils, Pair gain systems, Echo, Echo suppressor, 2 wire to 4 wire conversion; Hybrid, subscriber loop interface; BORSCHT

### **UNIT- II TELECOMMUNICATION TRAFFIC ENGINEERING**

Introduction, Unit of traffic, Traffic measurement, Network traffic load and parameters, Grade of service, Blocking probability, Lost call systems, Erlang B formula (Loss formula), Delay systems, Probability of delay

### **UNIT- III SWITCHING NETWORKS AND SIGNALLING**

Introduction, Single stage networks, Multistage networks, Two stage networks, Three stage networks, Three stage non blocking networks, Probability graph, Lee Formula, Time Division Switching, Combinational switching, Signalling, Customer line signaling, Pulse dialing, Tone dialing, DTMF signaling, SS#7 Architecture

## **UNIT- IV ISDN AND ATM NETWORKS**

Motivation for ISDN, ISDN Services, ISDN Architecture, Transmission Channels, User Network Interfaces, Basic Rate Interface, Primary Rate Interface, BISDN Reference Model, ATM technology, ATM cell header format, HEC, ATM switching

## **UNIT- V DATA NETWORKS**

Data Transmission in PSTN, Switching techniques for data transmission, Circuit switching, Message switching, Packet switching, Virtual circuit switching, Datagram, Data Communication Architecture, ISO-OSI Reference model, DSL, Features of ADSL, DMT

**Prerequisites:** Probability Theory, Analog and digital communication

**Text/ Reference books**

1. Thiagarajan Viswanathan, "Telecommunication switching systems and Networks", Prentice Hall of India Pvt. Ltd, 2007.
2. J.E. Flood, "Telecommunication switching, Traffic and Networks ", Pearson Education, 2006
3. John C Belamy, "Digital Telephony", John Willey, Third Edition

**Course Outcome:**

**CO1.** An Ability to analyze the switching behaviors of different switches & switching systems and have thorough understanding of Electronic Switching Systems and Telephone Network.

**CO2.** Ability to design & analyze Loss system and Delay System and have a thorough understanding of performance parameters like Traffic Intensity, Call Completion Rate, Grade of Service & Blocking Probability and Delay.

**CO3.** A thorough understanding of the operational principles and characteristics of digital switching and systems and signaling techniques, and an ability to design two stage and three stage blocking and non-blocking networks with optimum switching elements.

**CO4.** A thorough understanding of ISDN and ATM networks, ISDN Services and Architecture, BISDN model, ATM technology and ATM switching,

**CO5.** A thorough understanding of circuit switching, message switching and packet switching, OSI Reference model, DSL and DMT

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## INFORMATION THEORY AND CODING

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**Paper Code**                    **MEC-105**

**Course Credits**                4

**Lectures/ Week**                3

**Tutorials/ Week**                1

**Course description**            **UNIT-I INFORMATION THEORY AND SOURCE CODING**

Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, Shannon-Fano-Elias Coding, Lempel-Ziv Algorithm, Run Length Encoding, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Parallel Gaussian Channel, Channel Capacity for MIMO Systems, Random selection of codes.

**UNIT-II LINEAR BLOCK CODES FOR ERROR CORRECTION**

Introduction to Error Correcting Codes, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check Codes, Optional Linear Codes, Maximum Distance Separable Codes, Bounds on Minimum Distance, Space Time Block Codes.

**UNIT-III CYCLIC CODES AND BOSE-CHAUDHURI HOCQUENGHEM (BCH) CODES**

Introduction to Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check Codes, Circuit implementation of Cyclic codes.

Introduction to BCH Codes, Primitive Element, Minimal Polynomial, Generator Polynomial in Terms of Minimal Polynomial, Some Examples of BCH Codes, Decoding of

BCH Codes, Reed Solomon Codes, Implementation of RS encoders and decoders.

#### **UNIT-IV CONVOLUTIONAL CODES**

Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Distance Notations for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Performance Bounds.

#### **UNIT-V TRELLIS CODED MODULATION**

Introduction to TCM, The Concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder.

**Prerequisites:**

Probability, Linear Algebra, Digital Communication.

**Text Book:**

Information Theory, Coding and Cryptography, Ranjan Bose, 3<sup>rd</sup> Edition, Mc Graw Hill Education.

**Reference Book:**

Introduction to Error- Control Codes, S. Gravano, Oxford University Press.

**Course Outcome:**

**CO1:** An ability to analyze various source coding techniques, determine channel capacity, explain the need of channel coding theorem and discuss ramifications of Information capacity theorem.

**CO2:** Thorough understanding of the basics of error control coding, linear block encoding and decoding process and identification of some known good linear block codes on the basis of performance bounds.

**CO3:** An ability to generate cyclic codes, implement them in circuits and understand encoding and decoding of BCH and RS codes.

**CO4:** Capability to implement encoding using convolutional encoders, perform Viterbi decoding and apply distance bounds.

**CO5:** An ability to understand and design TCM scheme for AWGN channels.

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# **ELECTRONICS & COMMUNICATION ENGINEERING**

**M. TECH  
II SEMESTER**

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## 3G/ 4G NETWORKS AND CONVERGENCE

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**Paper Code**                      **MEC-201**

**Course Credits**                      4

**Lectures/ Week**                      3

**Tutorials/ Week**                      1

**Course description**                      **UNIT- I**  
1G, AMPS, 2G, GSM, IS-54, IS-136, IS-95, 2G-Cordless Telephone, 3G System, WCDMA, HSDPA, HSUPA, CDMA-2000, EDGE/UWC-136

**UNIT- II**  
GSM Services: Bearer Services, Tele services, Supplementary Services GSM System Architecture and Interface, MS, BSS, NSS, OSS, GSM Interface Standard, GSM Network Architecture.

**UNIT - III**  
Basic of GSM Air Interface/Radio link: Multiple Access, Frequency Hopping, Channel Type and Channel modes, Burst Formatting and Frame Hierarchy, Channel Codes, Mode of Voice Transmission, Discontinuous Reception (DRX) Power Control, GSM Evolution, IS-95 System Architecture, IS-95 Interface, IS -95 Functional model, "Communication Control plane" and "Radio Resource Control Plane" using IN concept.

**UNIT - IV**  
CDMA: Basic of CDMA, Fundamental of CDMA, Correlation Properties of Random CDMA Spreading Sequences, CDMA advantage and RAKE receiver Multi-User CDMA, Multi user CDMA downlink , multi user uplink and Asynchronous CDMA, CDMA near far problem.

**UNIT – V**  
GPRS, General Architecture, GPRS network elements: Serving GPRS Support node (SGSN), Gateway GPRS support node (GGSN), Charging gateway (CG), Lawful interception Gateway (LIG), Domain Name System ( DNS), GPRS Air Interface and Resource sharing with GSM, EDGE, Evolution of mobile communication system.



**Prerequisite Course**

1. An undergraduate course in Communication Theory
2. An undergraduate course in Mobile or Wireless Communications.

**Reference Books:**

1. Wireless Communications by Andrea Goldsmith, Cambridge University Press.
2. Wireless Communications: Principles and Practice by Theodore Rappaport, Prentice Hall.

**Course Outcomes:**

**CO1:** Providing a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. Building on the prior knowledge on digital communications, develop further understanding on the challenges and opportunities brought by the wireless medium in designing current and future wireless communication systems and networks.

**CO2:** Comprehensive understanding of modern mobile and wireless communication systems.

**CO3:** An in-depth understanding of the wireless channel and the related impairments

**CO4:** Understanding the fundamentals of CDMA and various issues related to code division multiple access.

**CO5:** Comprehensive overview of GPRS and detailed understanding of GPRS architecture

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## ADVANCED DIGITAL SIGNAL PROCESSING

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**Paper Code**                    **MEC-202**

**Course Credits**                4

**Lectures/ Week**                3

**Tutorials/ Week**                1

**Course description**            **UNIT- I MULTIRATE SIGNAL PROCESSING**  
Up-Scaling, Down-Scaling, Decimation, Interpolation, and Polyphase Decomposition.

**UNIT-II FILTER BANKS**

Analysis and Synthesis Filter Banks, Quadrature Mirror Filters (2-Channel and L-Channel), Multilevel Filter Banks.

**UNIT-III MULTI-RESOLUTION ANALYSIS OF WAVELETS**

Time Frequency Localization, Short Term Fourier Transform, and Discrete-Time Wavelet Transform.

**UNIT-IV WIENER FILTERING**

Principle of Orthogonally, Wiener Hopf Equations, IIR Wiener Filters, FIR Wiener Filters. Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Levinson Durban Algorithm, Recursive Least Square Method.

**UNIT-V POWER SPECTRUM ESTIMATION**

Maximum Likelihood Estimation, Estimates of Auto-Co-Relation Sequences, Non-Parametric and Parametric Spectral Estimation.

**Prerequisites:**                    Signals and Systems and Digital Signal Processing

**Text Book:**                        1. Simon Haykins, "Adaptive Filter Theory" 5<sup>th</sup> Edition, PHI India, 2013.  
2. S.K. Mitra, "Digital Signal Processing". 2<sup>nd</sup> Edition Tata McGraw-Hill Company, India, 2001.

**Course Outcomes:**

**CO1:** A thorough understanding of requirements of Multirate Signal Processing and their working principle of the same.

**CO2:** Capability to use the Filter Banks to improve the performance of Multirate Signal Processing systems.

**CO3:** A thorough understanding of requirements, use, and the limitations of different transformation processes in application of audio, speech, and image processing.

**CO4:** An ability to use the different prediction and filtering methods in application of audio, speech, and image processing.

**CO5:** An ability to utilize the various Power Spectrum Estimation techniques to estimate the power spectral density of a random signal from a sequence of time samples of the signal and their application of the same in different field of signal processing.

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## **MODERN INSTRUMENTATION AND SENSORS**

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<b>Paper Code</b>	<b>MEC-203</b>
<b>Course Credits</b>	4
<b>Lectures/ Week</b>	3
<b>Tutorials/ Week</b>	1
<b>Course description</b>	<p><b>UNIT- I</b> Review of Electronic measurement and instrumentation, Advance and intelligent techniques for the measurement of different types of impedances and other measuring quantities, Errors in higher order instruments (first order, second order)</p> <p><b>UNIT- II</b> Active bridge techniques for the measurement of simple and “in-circuit” resistances and impedances, Applications of various AC bridges in the measurement of non-electrical quantities</p> <p><b>UNIT- III</b> Data Acquisition System (DAS), Classification, characteristics and applications of DAS. Microprocessors used in precision measurement, its characteristics and application for the measurement of impedance, frequency etc., Data loggers</p> <p><b>UNIT- IV</b> Sensors in electronics instrumentation, Sensor networks, Wireless sensor networks and its applications, Concept of Biomedical Instrumentation, Various Sensors used in biomedical instrumentation e.g. Si, TiO<sub>2</sub> etc</p> <p><b>UNIT - V</b> Origin of biopotential and its used in the development of ECG and EEG machines, Basic requirements of amplifiers used in Electrocardiograph machine, Cardiac monitor and its details, Enthoven triangle for cardiac vector, Noise reduction techniques. Signal processors</p>

**Text/ Reference Books:**

1. C.S. Ranjan Et.al. "Instrumentation Devices & Systems", Tata McGraw Hill
2. L. Cromwellet.al "Biomedical Instrumentation & Measurements, Pearsons
3. D.V.S. Murthuy, "Sensor & Instrumentation", PHI
4. S. Sawahni, Dhanpat roy publication, "Advance Instrumentation

**Course Outcomes:**

**CO1:** Advance understanding towards the unit, dimension and different standards of measurement and the factors that affect the performance of the measurement such as accuracy, precision, sensitivity, resolution, errors and the ways to optimize /minimize the effects of these. To know the basic and operating principle of intelligent instruments.

**CO2:** The ability to measure and determine the simple and "in circuit quantities" using Active Bridge techniques. To know the classification and applications of various AC bridges for the measurement of non-electrical quantities.

**CO3:** Understanding towards the Classification, characteristics and applications of Data Acquisition Systems and Data loggers. To know the role of Microprocessors in precision measurement, its characteristics and application for the measurement of impedance, and frequency etc.

**CO4:** A thorough understanding of the fundamental concept and working knowledge of transducer, sensor, wireless sensor network, basic biomedical instruments and their applications.

**CO5:** Understanding of Origin of bio potential and its used in the development of ECG, EMG and EEG machines. Amplifiers used in these machines. Cardiac Monitor and its details. Noise reduction techniques and signal processors for biomedical instruments

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## **ADVANCED COMPUTER NETWORKS**

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**Paper Code**                      **MEC-204**

**Course Credits**                4

**Lectures/ Week**               3

**Tutorials/ Week**               1

**Course description**            **UNIT- I**  
Motivation for inter networking, physical network connection with routers, Internet Architecture, Significance of Internetworking and TCP/IP, Layering and TCP/IP Protocols, addresses for virtual internet, the IP addressing scheme, classes of IP addresses, routers and IP addressing principle.

**UNIT – II**  
Binding Protocol Address (ARP)= Address Resolution, Address Resolution protocol, ARP message delivery and format, Layering Address Resolution and Protocol Addresses, Virtual packets, the IP datagram, IP addresses and Routing table entries, best effort delivery, IP datagram header format.

**UNIT – III**  
IP Encapsulation, MTU and datagram size, reassembly, Fragment loss and fragmenting a fragment, need for reliable transport, transmission control protocol, the services TCP provides to application, achieving reliability, packet loss and retransmission, flow control and windows, three way handshake, congestion control, TCP segment format.

**UNIT – IV**  
The success of IP, motivation for change, IPv6 features, IPv6 datagram format, how IPv6 handles multiple headers, fragmentation, reassembly, and path MTU, IPv6 addressing, transition from IPv4 to IPv6 dual stack, tunneling and header translation.

**UNIT – V**  
Secure networks and policies, aspects of security, access and control password, encryption and confidentiality, message integrity, message authentication, digital signature, internet firewall concept, packet filtering, virtual private networks, tunneling, security technologies.

**Books:**

1. Computer networks and Internets, by Douglas E. Comer
2. Data Communication and Networking, by Behrouz A. Forouzan
3. Networks by Tannin Bourn

**Course Outcome:**

**CO1:** A familiarity to discriminate the functionality between the Layers in OSI model and TCP/IP suite

**CO2:** An ability to employ protocols to facilitate the transmission of frames and to decide the efficiency of the protocols

**CO3:** An understanding of IEEE standards designed to regulate the manufacturing and interconnectivity between different LANs

**CO4:** Ability to analyze the global addressing schemes in the Internet and configure the addresses for the subnet

**CO5:** A familiarity to future protocol IPv6 and understanding of network security.

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# **ELECTRONICS & COMMUNICATION ENGINEERING**

**M. TECH  
III SEMESTER**

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## ADVANCED SIGNAL PROCESSING

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**Paper Code**                      **MEC-301**

**Course Credits**                **4**

**Lectures/ Week**               **3**

**Tutorials/ Week**               **1**

**Course description**            **UNIT- I ACTIVE ELEMENTS AND THEIR APPLICATIONS**  
Introduction to active elements, Different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier to realize the active elements and their applications in analog signal processing.

**UNIT- II INTRODUCTION TO CM AND VM BIQUAD CIRCUITS**  
Introduction to current-mode and voltage mode circuit by showing their advantages, Realization of CM/VM biquad using different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier etc and their sensitivity analysis of frequency components.

**UNIT - III CMOS TRANSCONDUCTOR AND ITS APPLICATION**  
Introduction to CMOS transconductor, symbolic notation, CMOS structure and its small signal analysis, Realization of single element controlled oscillators (SECOs), Biquad Filters etc.

**UNIT - IV SIGNAL GENERATION CIRCUITS AND ITS APPLICATIONS**  
Introduction to Barkhausen criterion for oscillation, sinusoidal waveform generators using different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier etc, VCOs, Quadrature oscillator design.

## **UNIT - V IC ANALOG MULTIPLIER AND ITS APPLICATIONS**

Gilbert multiplier cell, 2-quadrant and 4-quadrant operations, IC analog multipliers: AD 533 and AD534, modulating, demodulating and frequency changing with multipliers, voltage-controlled filters and oscillators.

**Pre-requisite:** Active Filters and Signal Processing

**Text/Reference books**

1. Analog IC Design: the Current-mode approach: Edited by C. Toumazuo, F.J. Lidge and D.G. Haigh IEE Circuits and Systems Series 2.
2. Wai Kai Chen, "Passive and Active Filter Theory and Implementations:", John Wiley and Sons, 1986
3. Behzard Razavi, Design of Analog CMOS Integrated Circuits", Tata McGraw Hill Edition, New Delhi, 2003.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI: Signal and Information Processing" McGraw Hill International Editions, New Delhi, 1994

**Course Outcomes:**

**CO1:** A thorough understanding of the different active building blocks used in signal processing and their applications

**CO2:** The capability to realize and employ different current-mode and voltage mode circuit and their sensitivity analysis.

**CO3:** An understanding of CMOS transconductor and its application to design single elements oscillators and filters

**CO4:** A capability to design and realize signal generation circuits, and compare the performance with predicted circuit models.

**CO5:** An ability to gain an intuitive understanding of the role and applications of analog multipliers.

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## MODERN DIGITAL COMMUNICATION SYSTEMS

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**Paper Code**                      **MEC-302**

**Course Credits**                 4

**Lectures/ Week**               3

**Tutorials/ Week**               1

**Course description**            **UNIT- I OPTIMUM RECEIVER FOR AWGN CHANNELS**  
Waveform and vector channel models, Optimal Detection for a General Vector Channel, Waveform and Vector Channels, Optimal Detection for a General Vector AWGN Channel,, Implementation of the Optimal Receivers for AWGN Channels, Detection of Signalling Scheme with Memory, The Maximum Likelihood Sequence Detector(MLSD)

**UNIT - II DIGITAL COMMUNICATION THROUGH BANDLIMITED CHANNELS**  
Signal Design for Bandlimited Channels, Nyquist Criteria for zero ISI and Raised Cosine Function, Design of band Limited Signals with Controlled ISI- Partial Response Signaling: Signal design for Channel with Distortion.

**UNIT - III OPTIMAL RECEIVERS FOR CHANNELS WITH ISI AND AWGN**  
Data detection for controlled ISI, Optimal receivers for Channels with ISI and AWGN, Optimum Maximum Likelihood Receivers, A Discrete Time Model for a Channel with ISI , Maximum Likelihood Sequence Estimation for Discrete Time White Noise Filter Model

**UNIT - IV EQUALIZATION**  
Linear Equalization, Peak Distortion Criterion, Means Square Error (MSE) Criterion, Fractionally Spaced Equalizer (FSE), Base band and band pass Linear equalizer, baseband and band pass Linear Equalizer, Decision Feedback Equalization (DFE), Coefficient Optimization, Performance Characteristics of DFE, Iterative Equalization and Decoding: Turbo Equalization (Introduction only), Adaptive Linear Equalization and algorithms.

## **UNIT - V FADING CHANNELS: CHARACTERIZATION AND SIGNALING**

Characterization of fading Multipath channel, Channel Correlation Function and power Spectra, Statistical Models for Fading Channels, The Effect of Signal Characteristics on the Choice of Channel Model, Diversity techniques for Fading Multipath Channels, Signaling over a Frequency-Selective Slowly Fading Channel: RAKE Demodulator.

**Text Book:**

1. Communication System Engineering by JG Prokies and Masoud Salehi, PHI 2<sup>nd</sup> Edition 2006
2. Modern Digital and Analog Communication System by BP Lathi, Oxford University Press, Forth Edition 2010

**Reference Books:**

1. Digital analog and Communication Systems by Leon W Couch II, PHI, 6<sup>TH</sup> Edition, 2008
2. Digital Communication by Ian A Glover and Peter m Grant, Pearson education, 2<sup>nd</sup> Edition , 2004

**Course Outcome:**

**CO1:** A thorough understanding of optimal receivers for AWGN channels.

**CO2:** Capability to understand digital communication through band limited channels.

**CO3:** An ability to apply various techniques for data for channel with ISI & AWGN.

**CO4:** Capability to understand the various equalization techniques to combat ISI.

**CO5:** An ability to characterize and signal design for fading channels.

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