CURRICULUM FRAMEWORK AND SYLLABUS FOR OUTCOME BASED EDUCATION IN

Master of Science in Electronics and Communication Systems
M.Sc., (ECS)
Degree Program

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019- 2020 AND ONWARDS

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST
HICAS

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
(Affiliated to Bharathiar University and Accredited by NAAC)
COIMBATORE-641028
TAMILNADU, INDIA.
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HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS

VISION

To provide world class education to the students to face global challenges and to inculcate the latest trends in technological advancement. To cater the needs of the environmental and ethical values in the mind of students to become good citizens and entrepreneurs.

MISSION

The Mission of the college is to pursue a philosophy of perpetual acquisition of knowledge. The important policy is to provide value-based education and to bring out the hidden potentials in students that equip them to approach life with optimism.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

Post Graduates of Electronics and Communication Systems program will

PEO1: Have a successful career in electronics academia / industries / entrepreneurs.

PEO2: Critically analyze existing literature in an area of specialization and ethically develop innovative and research-oriented methodologies to solve the problems identified.

PROGRAM OUTCOME (PO)

PO1: Utilize the basic knowledge in mathematics, science and engineering in Electronics and Communication field.

PO2: Identify, formulate and solve complex problems to achieve demonstrated conclusions using mathematical principles and sciences.

PO3: Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.

PO4: Apply research-based knowledge to design and conduct experiments, analyse, synthesize and interpret the data pertaining to Electronics and Communication problems and arrive at valid conclusions.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO1: Apply the fundamental concepts of electronics and communication engineering to design a variety of components and systems for applications including signal processing, image processing, communication, networking, embedded systems, VLSI and control system.

PSO2: Select and apply cutting-edge engineering hardware and software tools to solve complex Electronics and Communication Engineering problems.

PSO3: Adapt the emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
COIMBATORE – 641028
SCHEME OF EXAMINATION – CBCS PATTERN
M.Sc., ELECTRONICS AND COMMUNICATION SYSTEMS
(For the students admitted from the Academic year 2019 – 2020 and onwards)

Course Code	Course Type	Course Title	Lecture Hours/ Week	Exam. Dur. Hrs	Max. Marks			Credit Points
					IE	EE	Total	
First Semester								
19ELP01	DSC	Digital and Network Communication	5	3	30	70	100	4
19ELP02	DSC	Microwave and RADAR Navigation System	5	3	30	70	100	4
19ELP03	DSC	8051Microcontroller with C Programming	5	3	30	70	100	4
19ELP04	DSC	Power Electronics	5	3	30	70	100	4
19ELP05	DSC	**Practical I:** Digital Communication Systems	5	5	40	60	100	4
19ELP06	DSC	**Practical II:**8051 Microcontroller and its Applications	5	5	40	60	100	4
Second Semester								
19ELP07	DSC	Optical Fiber Communication	5	3	30	70	100	4
19ELP08	DSC	Micro Electro Mechanical Systems	5	3	30	70	100	4
19ELP09	DSC	Embedded System and RTOS	5	3	30	70	100	4
19ELP10	DSC	Digital System Design using VHDL	5	3	30	70	100	4
19ELP11	DSC	**Practical III:** Optical and Microwave	4	5	40	60	100	4
19ELP12	DSC	**Practical IV:** Embedded System and RTOS	4	5	40	60	100	4
19GSP01	SEC	Skill Based: Cyber Security	2	-	100	-	100	2
Students Should Complete Value Added Courses, Online and Mini Project at the End of the First Year								
Third Semester								
19ELP13	DSC	Mobile Communication	5	3	30	70	100	4
19ELP14	DSC	Digital Signal Processing	5	3	30	70	100	4
19ELP15	DSC	Nanoelectronics and Nanosystems	5	3	30	70	100	4
19ELP16	DSC	Modern VLSI Design	5	3	30	70	100	4
19ELP17	DSC	**Practical V:**DSP AND MATLAB	5	5	40	60	100	4
19ELP18	DSC	**Practical VI:** VLSI Design	5	5	40	60	100	4
Fourth Semester								
19ELP19A	DSE	Wireless Sensor Networks	5	3	30	70	100	4
19ELP19B		ARM Core Processor		3				
19ELP20A	DSE	Real Time System Design	5	3	30	70	100	4
19ELP20B		Virtual Instrumentation		3				
19ELP21A	DSE	**Practical VII:** Internet of Things	5	5	40	60	100	4
19ELP21B		**Practical VIII:** Virtual Instrumentation		5				
19ELP22	DSC	Project Work	1	-	40	60	100	4
								90
Students Should Complete Value Added Courses, Online Courses (Or) Participation Certificates For Seminars, Workshops at the end of the Second Year								

REGULATION

1. Internal Marks

Components	Marks
Test I	5
Model Exam	10
Assignment	5
Attendance*	5
Seminar	5(3+2)**
TOTAL	30

*Split-up of Attendance Marks

- 75-79 - 1marks
- 80-84 - 2marks
- 85-89 - 3marks
- 90-94 - 4marks
- 95-100 - 5 marks

**3-For External paper presentation/ Mini Project

**2-Internal paper presentation/ Mini Project

Question Paper Pattern for IE test I

Duration: Two Hours **Maximum: 50Marks**

SECTION-A (3 x 6=18 Marks)

Answer **ALL** Questions **Either or Type**

ALL questions carry EQUAL Marks

SECTION-B (4 x 8=32 Marks)

Answer **ALL** Questions

Either or Type

ALL questions carry EQUAL Marks

Question Paper Pattern for IE Model Exam

Duration: Three Hours **Maximum: 70Marks**

SECTION – A (5x6=30 marks)
Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks

Q.No 1 to 5: Either or type questions
(One question from each Unit)

SECTION – B (5x8=40 Marks)
Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks

Q.No 6 to 10: Either or type questions
(One question from each Unit)

2 a) Components for Practical I. E.

Components	Marks
Test –I	20
Test - II	20
Total	**40**

2 b) Components for Practical E. E.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	**60**

3. Institutional/ Industrial Training, Mini and Major Project Work

Institutional / Industrial Training		Mini Project	Project Work		
Components	**Marks**		**Components**		**Marks**
I.E Work Diary Report Viva–voce Examination	 25 50 25	 - 50 50	*I. E* a) Attendance Marks b) Review Marks	 20 30	50
Total	**100**	**100**			
			*E.E**[1] a) Final Report Marks b) Viva-voce Marks	 120 30	150
				Total	**200**

*[1]Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners.

4. Components for Cyber Security Paper

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
Total	**100**

The question paper pattern is as follows:

a) Test I – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks
b) Test II – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks

Total = 80 Marks

- The passing minimum for Cyber Security is 50
- In case the candidate fails to secure 50 marks which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

5. Question Paper Pattern for EE Theory

Duration: Three Hours **Maximum: 70 Marks**

SECTION – A (5x6=30 marks)
Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks

Q.No 1 to 5: Either or type questions
(One question from each Unit)

SECTION – B (5x8=40 Marks)
Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks

Q.No 6 to 10: Either or type questions
(One question from each Unit)

Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP01	Course Title	Batch:	2019-2020 and Onwards
		DIGITAL AND NETWORK COMMUNICATION	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

Students can able to understand the building blocks of digital communication system and evaluate the network architecture and protocols.

Course Outcomes (CO)

K1	CO1	Understand the performance of PAM, PCM and DM in a digital communication system.
K2	CO2	Apply different types of digital modulation schemes for implementing digital radio.
K3	CO3	Analyze different types Network Architecture and Protocols
K4	CO4	Evaluate the working of LAN and ISDN.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP01	DIGITAL AND NETWORK COMMUNICATION	I
Units	Content	Hours
I	**Signal Digitization** Sampling Theorem – Pulse Amplitude Modulation – Pulse Position Modulation – Pulse Width Modulation – Pulse Code Modulation – Quantization: Quantization Noise – Delta Modulation: Adaptive Delta Modulation –Signal Power – Signal to Quantization Noise Ratio – PCM and DM Voice Signal Comparison – Time Division Multiplexing – CCITT.	13
II	**Digital Radio** Digital Radio Block Diagram – Digital Modulation: Amplitude Shift Keying– Frequency Shift Keying – Phase Shift Keying – Binary Phase Shift Keying – Quadrature Phase Shift Keying – Quadrature Amplitude Modulation – Digital Demodulation: Coherent Demodulation – Coherent Detection – FSK Demodulator – BPSK Demodulator – QPSK Demodulation – QAM Demodulation.	13
III	**Data Communication** Introduction Basic Terms and Concepts – Line Configurations – Topology – Components – Network – Protocols and Standards – MODEM: Standard and Types – Transmission Media – Circuit Switching Networks – Analog and Digital transmission Encoding and Modulating – Transmission Impairments: Attenuation – Distortion– Noise – Channel Capacity – Multiplexing: FDM – TDM – Error Detection and Control: CRC.	10
IV	**Network Architecture and Protocols** Layered Architecture – OSI model – Functions of Layers Data Link Control Protocols – TCP/IP Protocol suite – Addressing – ARQ – Stop and Wait – Sliding Window – Go back N and Selective – Synchronous Protocol: BSC– SDLC – HDLC– TCP/IP Model – SMTP – HTTP –FTP – Internetworking – IPV4 – IPV6.	12
V	**LAN and ISDN** LAN: Standard, Protocol – IEEE 802 Standards: ETHERNET – LLC – MAC-CSMA/CD – Token Ring – Token Bus – FDDI –ALOHA– SONET – ISDN: IDN – Channels – User Interfaces – ISDN Layers – Broad Band ISDN - Frame Relay – ATM: Concept and Architecture – ISDN Protocol– Physical Layer Protocol – D–channel Data Link Layer –Layer 3 Protocols– Network Signaling Systems: SS7 Protocol.	12

Text Books:

1. *Harold Kolimbiris, "Digital Communication Systems with Satellite and Fiber Optics Applications", Pearson Education, Third Indian Reprint, 2004. (Unit –I&II)*
2. *Behrous. A.Forouzan, "Data Communication and Networking", Tata McGraw Hill, fourth Edition, 2000. (Unit – III, IV and V)*

Reference Books:

1. *John G. Proakis, "Digital Communications", McGraw–Hill Higher Education, fourth Edition, 2000.*
2. *Ulysess Black, "Data Communications and Distributed Networks", III Edition, 2012.*

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CONTROLLER OF EXAMINATIONS
HICAS
CBE-28

Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP02	Course Title	Batch:	2019-2020 and Onwards
		MICROWAVE AND RADAR NAVIGATION SYSTEM	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To enable the students to learn the operations of Microwave Devices and Circuits. Also get deep Knowledge in RADAR and its Navigation Systems.

Course Outcomes (CO)

K1	CO1	Remember and understand Maxwell's Equations.
K2	CO2	Understand the working of various microwave devices.
K3	CO3	Analyze performance of wave guides and various antennas.
K4	CO4	Evaluate the working of RADAR system and its application.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	M

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP02	MICROWAVE AND RADAR NAVIGATION SYSTEM	I
Units	**Content**	**Hours**
I	**EM Wave Theory** Introduction to Microwaves: History – Region and Band Designations– Advantages – Applications – Maxwell's Equations: Ampere's Law – Faraday's Law – Gauss Law–Wave Equations – TEM/TE/TM/HE Wave Definitions –Transmission Lines - Two wire parallel transmission lines – Voltage and current relationship on transmission lines.	12
II	**Microwave Devices** Classification of Solid-State Microwave Devices – Varactor Diodes – PIN Diode–Schottky Barrier Diode (SBD) – Tunnel Diode –Gunn Diode – IMPATT Diode–TRAPATT Diode–BARITT Diodes – Quantum Electronic Devices.	12
III	**Microwave Amplifiers and Oscillators** Klystrons: Two Cavity Klystron Amplifier–Multicavity Klystron– Reflex Klystron–Traveling Wave Tube (TWT): Construction– Operation– Backward Wave Oscillator – Magnetrons: Cavity Magnetron Operation–Sustained Oscillations in Magnetron– Applications.	12
IV	**Waveguides and Microwave Antennas** Types of Waveguides– Propagation of Waves in Rectangular Waveguides– TE and TM Modes–Propagation of TM Waves in Rectangular Waveguide–TM Modes in Rectangular Waveguides. **Horn Antenna:** Sectoral E & H–plane Horn– Pyramidal Horn and Conical Horn – Parabolic Reflector: Feed for Parabolic Reflector – Lens Antenna – Slot Antenna – Micro Strip Antenna: Operation – Methods of Analysis – Polarization – Dual frequency.	12
V	**RADAR** Block Diagram – Classification: Doppler – Pulsed – Free Space RADAR Range Equation – Maximum Unambiguous Range –RADAR Receivers – Modulators – RADAR Displays: Plan Position Indicator (PPI) – Doppler Effect – CW Doppler RADAR – Moving Target Indicator (MTI) RADAR– Frequency Modulated CW RADAR – Radio Navigational Aids: Long Range Navigational Aid (LORAN).	12

Text Books:

1. *Dr. Kulkarni. M,* "*Microwave and Radar Engineering*", Umesh Publications, *Fifth Revised Edition, 2015.*
2. *Prasad K. D, "Antenna and Wave Propagation", Sathya Prakashan Publication, Third Edition, Reprint, 2004.*

Reference Book:

1. *Merrill I. Skolnik, "Introduction to RADAR Systems", Tata McGraw–Hill, Third Edition, Fifth Reprint, 2002.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP03	Course Title	Batch:	2019-2020 and Onwards
		8051 MICROCONTROLLER WITH C PROGRAMMING	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To enable the Students to learn the Instruction Set, Programming and Interfacing concepts of 8051 Microcontroller.

Course Outcomes (CO)

K1	CO1	Understanding the architecture of 8051.
K2	CO2	Impart knowledge about assembly and C language programs of 8051.
K3	CO3	Apply the function of interrupts and serial communication in real world applications.
K4	CO4	Analyze different types of external interfaces including LEDS, LCD, Keypad Matrix, Switches & Seven segment display.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	S
CO4	S	S	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP03	8051 MICROCONTROLLER WITH C PROGRAMMING	I
Units	**Content**	**Hours**
I	**Overview of 8051** Introduction to Computing – Microprocessor and Microcontrollers – Microcontrollers and Embedded Processors – Overview of 8051 Family – 8051 Architecture – Timers – Registers and Memory Organizations.	12
II	**8051 Assembly Language Programming** Inside the 8051 – Pin Out – Instruction Set: Addressing Modes – Data Transfer Instruction – Logical Instruction– Arithmetic Instructions – Jump and Call Instructions –Bit Oriented Instructions – Flags and Stack.	12
III	**Programming with C** Data Types – Time Delay Programming – I/O Programming – Logic Operations – Arithmetic Operations – Timer Programming – Counter Programming.	12
IV	**8051 Interrupts & Peripherals** 8051 Interrupts – Programming External Hardware Interrupts – 8051 Serial Communication Programming – Programming with Serial Communication Interrupts – Peripheral and Interrupt Programming in C.	12
V	**Real World Applications and Case Studies** LCD Interfacing – Keyboard Interfacing – Parallel and Serial ADC Interfacing – DAC Interfacing – Sensor Interfacing and Signal Conditioning – RTC Interfacing – Relays and Opto–Isolator Interfacing – Stepper Motor Interfacing – DC Motor Interfacing and PWM.	12

Text Book:

1. *Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C" by PHI, 2nd Edition, 2006.*

Reference Book:

1. *Kenneth J. Ayala, "The 8051 Microcontroller", Delmar Cengage Learning, 3rd Edition, 2004.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP04	Course Title	Batch:	2019-2020 and Onwards
		POWER ELECTRONICS	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To impart the Knowledge of different types of Power Semiconductor Devices and their switching characteristic Applications to the Students.

Course Outcomes (CO)

K1	CO1	Remember fundamental concepts of power electronic devices such as SCR, TRIAC, and Power MOSFET etc.
K2	CO2	Understand the working of controlled rectifiers.
K3	CO3	Analyze the working of static switches and voltage controllers.
K4	CO4	Ability to design inverters and power supplies for industrial needs.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	M	S	S
CO3	S	S	S	S
CO4	S	S	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP04	POWER ELECTRONICS	I
Units	**Content**	**Hours**
I	**Power Electronic Devices** Introduction – Power Semiconductor Devices: Power Diodes – Power Transistors: Power MOSFET – Insulated Gate Bipolar Transistor (IGBT)– Thyristors: SCR, TRIAC – Other Power Electronic Devices: SIT– MCT–PUT–SCS–SUS–GTO–SITH.	12
II	**Controlled Rectifiers** Controlled Rectifiers: Phase Controlled Converter – Single–Phase Semi Converter – Single–Phase Series Converter – DC Choppers: Step Down Operation: Step Down with RL Load –Step Up Operation – Switch Mode Regulator: Buck Regulator – Boost Regulator – Buck–Boost Regulator – CUK Regulator.	12
III	**Static Switches & AC Voltage Controllers** AC Switches : Single Phase –Three Phase – Three Phase Reversing Switches – AC Switches for Bus Transfer – DC Switches– Solid State Relays – AC Voltage Controller: ON–OFF Control –Phase Control – Single Phase Bidirectional Controllers: Resistive Loads – Inductive Loads– Cyclo Converters: Single Phase Cyclo Converters.	12
IV	**Inverters** Single Phase Bridge Inverters – Three Phase Inverters – Voltage Control: Single PWM –Multiple PWM –Sinusoidal PWM – Phase Displacement Control – 60–Degree PWM – Third–Harmonic PWM.	12
V	**Power Supplies** DC Power Supplies: Switched Mode – Resonant – Bidirectional – AC Power Supplies: Switched Mode – Resonant – Bidirectional – UPS – Static Circuit Breakers – Battery Charger – Emergency Lighting System.	12

Text Books:

1. *Rashid .M.H, "Power Electronics – Circuits, Devices and Applications", Third Edition, Prentice Hall, 2011.*
2. *Dr.Bimbhra.P.S, "Power Electronics", Khanna Publishers, Fifth Edition, 2014.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP05	Course Title	Batch:	2019-2020 and Onwards
		PRACTICAL I: DIGITAL COMMUNICATION SYSTEMS	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To impart the Knowledge of designing different types of pulse and digital modulators and demodulators.

Course Outcomes (CO)

K1	CO1	Understand the implementation of baseband modulation techniques.
K2	CO2	Apply the PCM and DM concept to design digital communication system.
K3	CO3	Analyze the working of various pulse modulation schemes.
K4	CO4	Design various digital modulators and demodulators for implementing digital communication system.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	S
CO4	S	S	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP05	PRACTICAL I: DIGITAL COMMUNICATION SYSTEMS	I

(Any 10 Experiments)

1. PAM Generation and Detection.
2. PWM Generation and Detection.
3. PPM Generation and Detection.
4. Frequency Sampling.
5. Pulse Code Modulation and Demodulation.
6. Linear Pulse Code Modulation and Demodulation.
7. ASK Generation and Detection.
8. FSK Generation and Detection.
9. PSK Generation and Detection.
10. QPSK Generation and Detection.
11. DPSK Generation and Detection.
12. BPSK Generation and Detection.
13. QAM Generation and Detection
14. Delta Modulation and Demodulation.
15. Adaptive Delta Modulation and Demodulation.

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP06	Course Title	Batch:	2019-2020 and Onwards
		PRACTICAL II: 8051 MICROCONTROLLER AND ITS APPLICATIONS	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To impart the practical skills of developing own ALP / C program for real world applications using 8051 microcontrollers.

Course Outcomes (CO)

K1	CO1	Recall and apply basic programming concepts of 8051 µC.
K2	CO2	Understand the data transfer operation through serial and parallel ports.
K3	CO3	Analyze the ADC & DAC interfacing with 8051µC.
K4	CO4	Design various embedded systems to solve real time problems using 8051µC.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	S	S	S
CO4	S	M	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP06	PRACTICAL II: 8051 MICROCONTROLLER AND ITS APPLICATIONS	I

(Any 10 Experiments)

1. Arithmetic and Logic Operations.
2. Data Transfer with Parallel Port.
3. Square Wave Generation using Internal Timer.
4. PWM Generation.
5. Solid State Relay Interface using Interrupt.
6. Interfacing Matrix Keypad.
7. Seven Segment Display Interface.
8. LCD Interface.
9. DAC Interface.
10. ADC Interface.
11. Stepper Motor Interface.
12. Serial Communication Interface.
13. Digital Clock.
14. Traffic Light Controller.
15. Water Level Controller.

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP07	Course Title	Batch:	2019-2020 and Onwards
		OPTICAL FIBER COMMUNICATION	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To facilitate the knowledge about Optical Fiber Fabrication, Optical Sources & detectors and its transmission techniques to the learners.

Course Outcomes (CO)

K1	CO1	Understand the fabrication process of optical fibers.
K2	CO2	Interpret the light propagation over optical fiber.
K3	CO3	Analyze the function of various light sources and detectors.
K4	CO4	Evaluate the performance of optical fibers in SONET, CATV and SDH etc.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	M
CO3	S	S	M	S
CO4	S	M	S	M

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP07	OPTICAL FIBER COMMUNICATION	II
Units	**Content**	**Hours**
I	**Optical Fiber Fabrication** Motivation for Light Wave Communications – Optical Spectral Bands – Nature of Light – Basic Optical Laws – Fiber Materials – Fiber Fabrication: Classification – Chemical Vapor Deposition – Multi– Element Glasses – Phasil System – Comparisons of Various Fabrication Processes–Drawing and Coating– Double Crucible Method–Rod–In Tube Method– Mechanical Properties.	10
II	**Optical Fibers and their Properties** Basic Structure of Optical Fiber –Conditions for Total Internal Reflection– Principles of light propagation – Types of fibers: Step Index & Graded Index fibers – Modes of Propagation: Single and Multimode– Calculation of Acceptance Angle –Numerical Aperture –Advantages and Application.	10
III	**Signal Degradation** Attenuation – Absorption – Scattering losses – Bending losses – Core and Cladding losses – Signal distortion in Fibers – Modal Delay – Factors contributing to dispersion – Group delay – Material dispersion – Waveguide dispersion – Signal distortion in Single Mode Fibers – Polarization mode dispersion – Characteristics of single mode fiber – Cut– off wavelength –Mode– Field Diameter – Single mode fiber bending loss – Dispersion power penalty – Total dispersion delay – Maximum transmission rate – Dispersion shifted fiber.	15
IV	**Light Sources and Photo Detectors** Light Sources: LED –Fiber LED Coupling –LASERS –Operation types– Spatial Emission– Current v/s output characteristics. Photo Detectors: Characteristics – Photo Emissive Type –Photo Conductive –Photo Voltaic Devices –PIN Photo diode –Avalanche Photo Diode.	15
V	**Optical Networks & Applications** Wave Length Division Multiplexing – Dense WLDM – Digital Subscriber Line Technology – SONET/SDH: SONET Network Layers –Frame Format– SONET Multiplexing – SONET Topologies – SDH – Community Antenna Television (CATV) –Special Applications: Digital Video Transmission Using Optical Fibers networks receiver – High performance receiver–Design of fiber optic receiver– Fiber based MODEMS.	10

Text Books:

1. *Gerd Keiser, "Optical Fiber Communications", TMH, fourth Edition, 10th Reprint, 2011.*
2. *Subir Kumar Sarkar, "Optical Fibres and Fibre Optic Communication Systems" S. Chand & Company LTD.*

Reference Book:

1. *Robert J Schoenbeck "Electronic Communications Modulation and Transmission", PHI, 1999.*

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CONTROLLER OF EXAMINATIONS ★ HICAS CBE-28

Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP08	Course Title	Batch:	2019-2020 and Onwards
		MICRO ELECTRO MECHANICAL SYSTEMS	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To learn the concept of MEMS in control systems and Correlate, apply the same in open and closed loop systems.

Course Outcomes (CO)

K1	CO1	Recall the concepts of MEMS and Microsystems.
K2	CO2	Understand the fundamentals of control systems.
K3	CO3	Analyze the time and frequency-domain responses of first and second-order systems.
K4	CO4	Evaluate the stability analysis of closed-loop control system.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	S
CO4	S	S	M	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP08	MICRO ELECTRO MECHANICAL SYSTEMS	II
Objective:	To learn the basics of micro electro mechanical system design and fundamentals control system.	

Unit No	Content	Hours
I	**Overview of MEMS & Micro System** MEMS & Micro systems - typical MEMS & Micro system products – Evaluation of Micro fabrication – Microsystems and Microelectronics – The Multidisciplinary nature of Micro Systems design and Manufacture- Micro Systems and miniaturization – applications of Micro Systems in Automotive industry – applications of Microsystems in other industries.	12
II	**Working Principles of Microsystems** Micro sensors – Micro actuation using Thermal Forces – Actuation Using shape memory Alloys – Actuation Using Piezoelectric crystals – Actuation using Electrostatic forces – MEMS with Micro Actuators – Micro Accelerometers – Micro Fluidies.	12
III	**Concepts of Control Systems** Introduction to control systems-Human elements in control systems-block diagram fundamentals- open loop control system-closed loop control systems- Linear and Nonlinear Systems- Effect of feedback on Overall gain, Stability, Sensitivity and Noise-Physical system representation: Electrical Systems and thermal system.	12
IV	**Block Diagrams, Signal Flow Graphs and Time Response Analysis** Introduction to Block Diagrams-Block diagram reduction-Signal flow graph-Signal flow graph algebra-construction of signal flow graph from block diagram- Mason's gain formula-Time Response Analysis of First and second order systems-Steady state error.	12
V	**Stability Analysis, Compensation and Controllers** Stability Analysis of Control System: Bode plot- Routh Hurwitz criterion-Root Locus-Nyquist Criterion- Principles of P-PI-PD-PID Controllers- Cascade and feedback compensation, lag, lead, lag-lead Compensation.	12

Text Books:

1. *Tai Ran Hsu – MEMS & Micro systems Design and Manufacture – Tata McGraw Hill. (Unit I & II)*
2. *S.N. Verma, "Automatic Control Systems", Khanna Publishers. (Unit III)*
3. *A. NagoorKani, "Control Systems", RBA Publications. (Unit IV & V)*

Reference Books:

1. *Katsuhiko Ogata "Modern Control Engineering". Pearson Education Asia, Fourth edition, 2002.*
2. *Benjamin C.Kuo "Automatic Control Systems", PHI, 1995.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP09	Course Title	Batch:	2019-2020 and Onwards
		EMBEDDED SYSTEM AND RTOS	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To enable the students to understand the basics of RTOS and become familiar with PIC microcontroller in embedded systems.

Course Outcomes (CO)

K1	CO1	Understand the fundamentals of Embedded system.
K2	CO2	Ability to get the knowledge in RTOS.
K3	CO3	Examining the functions of RTOS through case studies.
K4	CO4	System Design using PIC Microcontrollers.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	S
CO4	S	M	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP09	EMBEDDED SYSTEM AND RTOS	II
Units	**Content**	**Hours**
I	**Embedded Systems** Definition and Classification – Overview of Embedded Controllers – Exemplary High Performance Processors – CISC and RISC Architecture– Hardware Unit in an Embedded System– Software Embedded into a System – Exemplary Applications – Embedded Systems on a Chip in VLSI circuit.	10
II	**PIC 16F877 Architecture and Instruction Set** Device Overview – Architecture – Memory Organization – Status Register– Option Register – INTCON Register – PCON Register – I/O Ports– Data EEPROM – Instruction Set: Byte Oriented Operations – Bit Oriented Operations– Literal and Control Operations.	15
III	**PIC Peripheral Features** TIMER0 Module – TIMER1 Module – TIMER2 Module – Capture/ Compare/ PWM Modules – I^2C transmission and reception – USART – ADC Module – Special features of the CPU : Oscillator Selection – Power on Reset – Power up Timer – Oscillator Startup Timer – Brownout Reset– Interrupts – Watchdog Timer –SLEEP.	10
IV	**Embedded Software Architecture & Operating System Services** Round Robin – Round Robin with Interrupts – Function Queue Scheduling Architecture– Real Time Operating Systems (RTOS) – Tasks and Data – Semaphores and Shared Data– Message Queues, Mail Box and Pipes – Timer Function – Events – Memory Management.	15
V	**Real Time Operating Systems** Study of Micro C/OS–II – Vx Works – Other Popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS: Case Definition, Multiple Tasks and their Functions – Creating a list of Tasks, Functions and IPCs – Exemplary Coding Steps.	10

Text Books:

1. *Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw–Hill, First Reprint, 2003.*
2. *Martin.P.Bates, "Programming 8–bit PIC Microcontrollers in C Interactive Hardware Simulation", Elsevier, Second Edition,2008.*
3. *David E. Simon, "An Embedded Software Primer", Addison Wesley, Ninth Impression, 2011.*

Reference Books:

1. *Shibu KV, "Introduction to Embedded System" Tata McGraw Hill, 2010.*
2. *Micro C OS II Reference Manual, Salvo User Manual & VX works Programmers Manual.*
3. *PIC 16f877A DataSheet.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP10	Course Title	Batch:	2019-2020 and Onwards
		DIGITAL SYSTEM DESIGN USING VHDL	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To import the concepts of digital circuit design using VHDL and equip the students to develop new digital systems.

Course Outcomes (CO)

K1	CO1	Understand the functionality of digital systems.
K2	CO2	Analyze and synthesize digital modules and circuits for a wide application range.
K3	CO3	Design and implement hardware digital systems using VHDL.
K4	CO4	Interpret the specifications of programmable reconfigurable devices and select the appropriate for the application in hand.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	S
CO3	S	S	M	M
CO4	S	S	S	S

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP10	DIGITAL SYSTEM DESIGN USING VHDL	II
Units	**Content**	**Hours**
I	**Digital Logic Design** Combinational Logic – Boolean Algebra and Algebraic Simplification – Karnaugh Maps –Designing with NAND and NOR Gates – Flip–Flops and Latches – Mealy Sequential Circuit Design – Moore Sequential Circuit Design – Sequential Circuit timing – Tristate Logic and Busses.	12
II	**VHDL** Computer Aided Design – HDL – VHDL Description of Combinational Circuits – VHDL Modules – Sequential Statements – Modeling of Flip–Flops – Wait Statement and Delays – Data Types and Operators – VHDL Libraries.	12
III	**VHDL Modeling** Modeling Registers and Counters using VHDL Process Statement – Behavior and Structural Modeling – Variables, Signals and Constants – Arrays – Loops in VHDL – Assert and Report Statement.	12
IV	**Programmable Logic Devices** Overview of PLD – Simple Programmable Logic Devices – Complex Programmable Logic Devices (CPLD) – Field Programmable Gate Arrays (FPGA).	12
V	**Design Examples** BCD to Seven Segment Display Decoder– Adders – Traffic Light Controllers – State Graphs for Control Circuits – Score Board and Controller – Synchronization and Denouncing – Multiplier – Keypad Scanner – Binary Divider.	12

Text Books:

1. *Charles H. Roth, Jr. Lizy Kurian John, "Digital System Design Using VHDL" Cengage Learning, First Indian Reprint, 2012.*
2. *Bhaskar.J, "VHDL Primer", PHI, Low price Edition, 2001.*

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP11	Course Title	Batch:	2019-2020 and Onwards
		PRACTICAL III: OPTICAL AND MICROWAVE	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To impart the knowledge of establishing optical and microwave communication.

Course Outcomes (CO)

K1	CO1	Understand the working of analog and digital optical communication system.
K2	CO2	Analyze the Attenuation, Bending and Coupling Loss of optical fiber.
K3	CO3	Experiment the characteristics of Reflex Klystron and Gunn Diode Oscillator.
K4	CO4	Demonstrate the performance of various microwave components.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	M
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP11	PRACTICAL III: OPTICAL AND MICROWAVE	II

(Any 10 Experiments)

1. Study of Fiber Optic Trainer.
2. Establishment of Analog Fiber Optic Link.
3. Establishment of Digital Fiber Optic Link.
4. Measurement of Attenuation Loss.
5. Measurement of Bending Loss.
6. Measurement of Coupling Loss.
7. Study of Microwave Components and Instruments.
8. Reflex Klystron Characteristics.
9. Frequency Measurement of Reflex Klystron.
10. VSWR Measurement.
11. Attenuator Characteristics.
12. Study of Gunn Diode Oscillator.
13. Measurement of Unknown Load Impedance.
14. Isolator and Circulator Characteristics.
15. Horn Antenna Characteristics.

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Programme Code:	MEL	Programme Title: M.Sc., (ECS)		
Course Code:	19ELP12	Course Title	Batch:	2019-2020 and Onwards
		PRACTICAL IV: EMBEDDED SYSTEM AND RTOS	Semester:	II
Hrs/Week:	5		Credits:	5

Course Objective

To impart the knowledge of developing own embedded systems for various applications.

Course Outcomes (CO)

K1	CO1	Recall and apply basic programming concepts.
K2	CO2	Understand the interfacing concept of various peripherals with embedded microcontroller.
K3	CO3	Analyze the data transfer information through serial and parallel ports.
K4	CO4	Demonstrate various real world applications of Embedded Systems

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	M
CO4	S	S	M	M

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP12	PRACTICAL IV: EMBEDDED SYSTEM ANDRTOS	II

(Any 10 Experiments)

(Using PIC 16F84A IC/ PIC 16F877 Kit/ RTOS Kit)

1. Delay Generation using Timer.
2. PWM Generation.
3. LED Interfacing and Object Counter.
4. Interfacing Solid State Relay.
5. Interfacing Seven Segment Display.
6. LCD Interface.
7. DAC Interface.
8. Internal ADC Programming.
9. External Event Counter using Timer–1.
10. Programming using interrupts.
11. Serial Port Interfacing Using RS232.
12. Water Level Controller.
13. Stepper Motor Interface.
14. RTOS Multi tasking.
15. Temperature Monitoring and Control.

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP13	Course Title	Batch:	2019-2020 Batch Only
		MOBILE COMMUNICATION	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To make the Student familiar with the Cellular Concept, Design and Wireless Network.

Course Outcomes (CO)

K1	CO1	Understand the 2G, 3G and 4Gcellular communication systems.
K2	CO2	Analyze the proper multiple accessing methods depending on channel model.
K3	CO3	Identify traffic channels for call processing
K4	CO4	Evaluate the key performance metrics of a cellular communication system and design.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	M
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP13	MOBILE COMMUNICATION	III
Units	**Content**	**Hours**
I	**Wireless Communication Systems** Evolution – Paging Systems – Cordless and Cellular Telephone Systems – Trends in Cellular Radio and Personal Communications – Second Generation: 2.5G Mobile Radio Networks – TDMA Standards – IS–95B for 2.5G CDMA – Third Generation: W–CDMA – CDMA200 – TD– SCDMA – 4G features and challenges – Wireless Local Loop – Wireless Local Area Networks -- Bluetooth and Personal Area Network.	12
II	**Cellular Concept** Introduction – Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and System Capacity: Co–channel Interference and System Capacity–Channel Planning for Wireless Systems–Adjacent Channel Interference–Power Control for Reducing Interference – Trunking and Grade of Service – Improving Coverage & Capacity in Cellular Systems: Cell Splitting – Sectoring.	12
III	**Multiple Access Techniques** Multiple Access: FDMA – TDMA –SSMA – SDMA – Packet Radio: Protocols – CSMA – Reservation – Capture Effect – Capacity of Cellular Systems: Cellular CDMA	12
IV	**Wireless Networks** Differences Between Wireless and Fixed Telephone Networks: Public Switched Telephone Network (PSTN), Limitations, Merging Wireless Networks and PSTN – Development of Wireless Networks – Fixed Network Transmission Hierarchy – Wireless Data Services – Personal Communication Services/Networks (PCS/PCNs) – Protocols for Network	12
V	**4G Networks** 4G Vision – 4G Features and Challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM–MIMO Systems, Adaptive Modulation and Coding with time slot scheduler, Cognitive Radio.	12

Text Books:

1. *Theodore S. Rappaport, "Wireless Communications, Principles, Practice", PHI, 2nd Edition,2012.*
2. *GottapuSasibhushana Rao, "Mobile Cellular Communication", Pearson,2013.*
3. *Vijay Garg, "Wireless Communications and Networking", Elsevier, First Edition, 2007.*

Reference Book:

1. William Stallings, "Wireless Communication and Networking", PHI, 2nd Edition,2003.

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP14	Course Title	Batch:	2019-2020 Batch Only
		DIGITAL SIGNAL PROCESSING	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To impart Knowledge on the concept of Analyzing Continuous and Discrete Time Signals & Systems in the Time and Frequency Domain, Design Techniques for Digital Filters to the Students.

Course Outcomes (CO)

K1	CO1	Understand the performance and frequency transforms for the signals
K2	CO2	Ability to design & analyze DSP systems like FIR and IIR Filter etc..
K3	CO3	Integrate computer-based tools for engineering applications
K4	CO4	Evaluate the working of filters with required applications.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELP14	DIGITAL SIGNAL PROCESSING	III
Units	**Content**	**Hours**
I	**Signals and Systems** Introduction – Classification of Signals: Multichannel and Multi–dimensional signals, Continuous time and Discrete time signals, Analog and Digital Signals, Deterministic and Random Signals, Energy and Power Signals, Periodic and Non–Periodic Signals – Signal Processing Systems – Advantages of Digital Signal Processing – Elements of Digital Signal Processing System – Discrete Time Signals – Representation – Elementary Discrete Time Signals – Manipulation of Discrete Time Signals. Introduction to MATLAB – MATLAB Environment – MATLAB Operators.	12
II	**Discrete Time Systems** Basic Building Block – Classification – Linear Time Invariant (LTI) Systems – Convolution of Two Discrete Time Signals – Procedure for Computing Convolution Sum – Linear Convolution – Properties of Convolution Sum – Sampling of Continuous Time Signals.	12
III	**Transform and Analysis** Introduction – Z–Transform – Region of Convergence – Properties of Z–Transform – Causality and Stability – Discrete Time Fourier Transform – Convergence – Properties of DTFT: Periodicity, Linearity, Differentiation in Frequency Domain, Parseval's Relation.	12
IV	**Digital Filters** Introduction – Major Considerations in Using Digital Filters – Comparison Between Digital and Analog Filters – IIR and FIR Digital Filters – Realization Procedure for Digital Filters: Recursive, Non–recursive, FFT Realizations – Notch Filter – Comb Filter –All Pass Filters.	12
V	**Applications** Speech Processing: Speech Production Model – Channel Vocoder – Computer Voice Response System – Airborne Surveillance RADAR for Air Traffic Control (ATC) – Long Range Demonstration RADAR (LRDR).	12

TextBooks:

1. *Farooq Husain, "DigitalSignalProcessing", Umesh Publications, 3rd Edition, 2012.*
2. *Salivahanan . S, Vallavaraj. A, Gnanapriya. C, "Digital Signal Processing", Tata McGraw–Hill Publishing Company Limited, 13th Reprint, 2004.*
3. *Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson, Eighth Impression.*

Reference Book:

1. *Ramesh Babu. P, "Digital Signal Processing", Scitech Publications, 2nd Edition, 2003.*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP15	Course Title	Batch:	2019-2020 Batch Only
		NANOELECTRONICS AND NANOSYSTEMS	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To make the Students familiar in the idea of Nanoelectronics and its implications inthe Nano System Design.

Course Outcomes (CO)

K1	CO1	Understand the concepts of silicon technology road map.
K2	CO2	Examine the implication of nano devices in evolution.
K3	CO3	Relate the construction and working of RTD, RTBT and SET.
K4	CO4	Inspire on emerging nano systems such as DNA computers, Bio and Molecular electronics.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP15	NANOELECTRONICS AND NANOSYSTEMS	III
Units	**Content**	**Hours**
I	**Silicon Technology** Development of Microelectronics – Challenge Initiated by Nanoelectronics – Potentials of Silicon Technology – Microminiaturization: Methods and Limits – Mechanical Systems – Integrated Optoelectronics – From Microelectronics towards Bimolecular Electronics.	12
II	**Quantum Electronics** Electromagnetic Fields and Photons – Schrodinger Equation – Electrons in Potential Wells – Photons Interacting with Electron in Solids – Quantum Electronics: Quantum Electronic Devices – Short Channel MOS Transistor – Split Gate Transistor – Electron Wave Transistor –ElectronSpin Transistor – Quantum Cellular Automata – Quantum Dot Array.	12
III	**Tunneling Devices** Tunneling Element: Tunnel Effect and Tunneling Elements – Tunneling Diode – Resonant Tunneling Diode – Technology of RTD – Digital Circuit Design Based on RTD: Memory Circuits – Basic Logic Circuits – Dynamic Logic gates – Digital Circuit Design Based on RTBT.	12
IV	**Single Electron Transistor (SET)** Principle of SET – Coulomb Blockade – Performance of SET – SET Technology – SET Circuit Design: Wiring and Drivers – Logic and Memory Circuits – SET Adder – Comparison Between SET andFET Circuit Design.	12
V	**Emerging Nano Systems** Biological Networks – Biology Inspired Concepts – DNA Computer – Quantum Computer – Bioelectronics – Molecular Electronics – Fullerenes and Nano Tubes – Polymer Electronics – Self–Assembly – Optical Molecular Memories.	12

Text Book:

1. Goser. K, Glosekotter. P and Dienstuhl .J, "Nanoelectronics and Nanosystems", Springer International Edition, First Indian Reprint,2005.

Reference Books:

1. Poole .C.P and Owens .F.J, "Introduction to Nanotechnology", John Wiley & Sons,2003.
2. Ratner M.A and Ratner. D, "Nanotechnology; a Gentle Introduction to the Next Big Idea", Prentice Hall, 2002.

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP16	Course Title	Batch:	2019-2020 Batch Only
		MODERN VLSI DESIGN	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To equip the Students to learn about the Modern VLSI and other Advanced IC Design process.

Course Outcomes (CO)

K1	CO1	Understand fabrication of passive and active electronics components.
K2	CO2	Relate the VLSI design flow and VLSI circuit design process.
K3	CO3	Examine the design flow of programmable logic devices.
K4	CO4	Inspect the chip design issues and demonstrate the various design applications using ASIC.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP16	MODERN VLSI DESIGN	III
Units	**Content**	**Hours**
I	**VLSI Fabrication Technology** History of VLSI – Fabrication: MOSFET – Wafer Manufacture – Wafer Cleaning – Doping and Impurities Addition – Growth & Deposition of Dielectric Films – Masking and Lithography– Etching and Metallization– Packing – Fabrication of Passive Components – Process Flow for CMOS Fabrication – Twin Tub Process.	12
II	**VLSI Design Flow** VLSI Circuit Design Process – Design Flow – Architecture Specification and Design Constraints – HDL Capture and RTL Coding – Logic Simulation – Logic Synthesis – Logic Optimization – Formal Verification– Static Timing Analysis– Floor Planning – Placement& Routing – Layout Vs Schematic – Design Rule Check.	12
III	**Programming Logic Devices** Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation Approaches in VLSI Design – Custom or Full Custom Design – Semicustom Design – Gate Arrays – Complex Programmable Logic Devices (CPLD) – CPLD Architectures.	12
IV	**Issues in Chip Design** Requirements of Chip Design – System On Chip (SOC) – Chips Power Consumption – Clock – Chip Reliability – Analog Integration in the Digital Environment – Case Study.	12
V	**ASIC Design** Chip Design – Design Methodologies: IBM ASICs– HP7100LC – Wiper Digital Video Chip – Kitchen Timer Chip: Specification and Architecture– Logic and Layout Design – Validation – Microprocessor Data Path: Clocking and BusDesign.	12

Text Books:

1. *Lal Kishore.K, Prabhakar.V.S.V, "VLSI Design", I.K. International Publishing House Pvt. Ltd., 2010.(Unit I–IV)*
2. *Wolf.W, "Modern VLSI Design", Prentice Hall, 4th Edition, 2008.(UnitV)*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP17	Course Title	Batch:	2019-2020 Batch Only
		PRACTICAL V: DSP AND MATLAB	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To impart the knowledge of designing a DSP system for various applications with inclusion of MATLAB Code.

Course Outcomes (CO)

K1	CO1	Recall and apply basic signal processing operations.
K2	CO2	Demonstrate the abilities towards MATLAB based implementation of various DSP systems.
K3	CO3	Analyze the architecture of a DSP Processor.
K4	CO4	Design a system for various applications of DSP.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP17	PRACTICAL V: DSP AND MATLAB	III

(Any 10 Experiments)

(Using TMS320C5XX/TMS320C54XX/TMS320C67XX/MATLAB)

1. Arithmetic Operations.
2. Convolution of Two Discrete Signals.
3. Correlation of Two Discrete Signals.
4. Waveform Generation.
5. Frequency Sampling Method.
6. Impulse, Step, Exponential & Ramp Functions.
7. Solving Z–Transform.
8. Solving Differential Equations.
9. Design of FIR Filter.
10. Design of IIR Filter.
11. Voice Storing & Retrieval
12. Quantization Noise.
13. Echo Cancellation
14. Amplitude Modulation and FFT Response.
15. Frequency Analysis using DFT.

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP18	Course Title	Batch:	2019-2020 Batch Only
		PRACTICAL VI: VLSI Design	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective

To provide an introduction to the fundamentals of Computer-Aided Design tools for the modelling, design, analysis, test, and verification of digital Very Large-Scale Integration (VLSI) systems.

Course Outcomes (CO)

K1	CO1	Design the combinational and sequentional logic circuits using Digital IC's/ Lab VIEW/ VHDL.
K2	CO2	Demonstrate the working of various combinational logic circuits.
K3	CO3	Validate the working of various sequential logic circuits.
K4	CO4	Review the working of FIFO.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	S	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP18	PRACTICAL VI: VLSI Design	III

(Using Digital ICs / VHDL / Lab VIEW)
(Any 10 Experiments)

1. Solving of Boolean Equations.
2. Half Adder and Full Adder.
3. Half Subtractor and Full Subtractor.
4. Encoder and Decoder.
5. Multiplexer.
6. De–multiplexer.
7. Latches and Flip–Flops.
8. Parity Generator.
9. Comparators.
10. Shift Registers.
11. Simple ALU Design.
12. Synchronous and Asynchronous Counter.
13. Clock Divider and Generator.
14. FIFO Design.
15. UART and SPI Module.

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP19A	Course Title	Batch:	2019-2020 Batch Only
		ELECTIVE I: (A) WIRELESS SENSORNETWORKS	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

To equip the Students in Sensor Node essentials, Architectural details, MediumAccess, Routing Issues and the Energy Constrained Operational Scenario.

Course Outcomes (CO)

K1	CO1	Relate the basic concepts of wireless sensor networks, internet and computing
K2	CO2	Illustrate wireless sensor network with sensor nodes.
K3	CO3	Examine the ad-hoc wireless network.
K4	CO4	Evaluate the significance of wireless sensor networks and recent advancements.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP19A	ELECTIVE I: (A) WIRELESS SENSORNETWORKS	IV
Units	**Content**	**Hours**
I	**Wireless LANS, PANS AND MANS** Introduction – Fundamentals of WLAN – Technical Issues – Network Architecture – IEEE 802.11– Physical Layer – MAC Layer Mechanism – CSMA/CA – Bluetooth – Specification – Transport Layer – Middleware Protocol Group – Bluetooth Profiles – WLL – Generic WLL Architecture–Technologies – Broadband Wireless Access – IEEE802.16– Differences Between IEEE 802.11 and 802.16 – Physical Layer – Data Link Layer.	12
II	**Wireless Internet** Address Mobility – Inefficiency of Transport Layer and Application Layer Protocol – Mobile IP – Simultaneous Binding – Route Optimization– Mobile IP Variations – Handoffs – IPv6 Advancements – IP for Wireless Domain – Security in Mobile IP – TCP in Wireless Domain – TCP Over Wireless – TCPs –Traditional – Snoop – Indirect – Mobile Transaction–Oriented – Impact ofMobility.	12
III	**AD–HOC Wireless Network** Introduction – Issues – Medium Access Scheme – Routing – Multicasting – Transport Layer Protocol – Pricing Scheme – QoS Provisioning – Self–Organization – Security – Addressing – Service Discovery – Energy Management – Deployment Consideration –Ad–Hoc WirelessInternet.	12
IV	**Wireless Sensor Network** Applications of Sensor Network, Comparisons with MANET – Issues and Design Challenges – Architecture – Layered and Clustered– Data Dissemination – Data Gathering MAC Protocols – Location Discovery – Quality of Sensor Network – Coverage and Exposure.	12
V	**Recent Advances in Wireless Network** UWB Radio Communication – Operation of UWB Systems – Comparisons with Other Technologies – Major Issues – Advantages and Disadvantages, Wi–Fi Systems– Service Provider Models, Issues, Interoperability of Wi–Fi and WWAN, Multimode 802.11 – IEEE 802.11a/b/g – Software Radio–based Multimode System, MeghadootArchitecture.	12

Text Books:

1. *Siva Ram Murthy C and Manoj B.S, "Ad Hoc Wireless Networks – Architecture and Protocols", Pearson Education, 2nd Edition,2012.*
2. *William Stallings, "Wireless Communication and Networks", Prentice Hall, second Edition,2005.*

Reference Book:

1. *Kaveh Pahlavan and Prashant Krishnamurthy, "Principle of Wireless Network– A unified approach", Prentice Hall,2006*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP19B	Course Title	Batch:	2019-2020 Batch Only
		ELECTIVE I: (B) ARM CORE PROCESSOR	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

To enable the Students to have familiar with an ARM Embedded System, techniquesof interfacing ARM Processor & Peripherals devices related to Embedded System.

Course Outcomes (CO)

K1	CO1	Understand the features of embedded systems and architecture of ARM7.
K2	CO2	Analyze the instruction set ARM7
K3	CO3	Evaluate the operation of exceptions, interrupts and interrupt handling.
K4	CO4	Test the interfacing of peripheral devices to LPC2378.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP19B	ELECTIVE I: (B) ARM CORE PROCESSOR	IV
Units	**Content**	**Hours**
I	**Introduction to ARM Embedded System** RISC Design Philosophy –ARM Design Philosophy – Embedded System Hardware Memory – Peripherals – Embedded System Software Initialization (Boot) Code – Operating System –Applications.	12
II	**ARM Processor Fundamentals** ARM Core Data Flow Model – Registers – Current Program Status Register (CPSR) – Processor Modes – Bank Registers –State and Instruction Sets – Interrupts Masks – Condition Flags – Conditional Execution – Pipeline – Exceptions, Interrupts & Vector Table – Core Extension – ARM Processor Families.	12
III	**Efficient C Programming** C Compiler and Optimization – Basic C Data Types – C Looping Structure– Register Allocation – Function Calls – Pointer Aliasing – Structure Arrangement – Bit–fields – Unaligned Data and Endianness – Division – Floating Point – Inline Functions and Inline Assembly – Portability issues.	12
IV	**ARM7TDMI MCU (Analog Devices LPC2378)** Features – Functional Block Diagram – General Description – Pin Configuration & Function Descriptions – Overview of the AR7TDMI Core – Exceptions – ARM Registers Interrupt Latency – Memory Organization – Memory Access – Flash/EE Memory – SRAM –Memory Mapped Register.	12
V	**Hardware Configuration** ADC – DAC – Oscillator and PLL – PWM – General Purpose I/O– Serial Port MUX – UART Serial Interface – I^2C – Timer Life Time–GeneralPurposeTimer–WakeUpTimer–WatchDogTimer–General Purpose Timer 4.	12

Text Books:

1. *Andrew N.Sloss, Dominic Sysmes and Chris Wright "ARM System Development Guide", Morgan Kaufmann Publishers, Reprinted, 2016.*
2. *Data Sheet Reference (Analog Devices LPC 2377/78).*

Reference Book:

1. *Frank Vahid "Embedded System Design", Tata McGraw Hill Publication Company Ltd, Third Edition, Reprint,2014.*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP20A	Course Title	Batch:	2019-2020 Batch Only
		ELECTIVE II: (A) REAL TIME SYSTEM DESIGN	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

To enable the Students to design a real–time computer systems of their own.

Course Outcomes (CO)

K1	CO1	Understand the principles of real time environment and IoT.
K2	CO2	Analyze the working of various embedded system components and analyze the various real time systems using debugging components
K3	CO3	Evaluate the system life cycle requirements.
K4	CO4	Design various real time applications for emerging trends.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP20A	ELECTIVE II: (A) REAL TIME SYSTEM DESIGN	IV
Units	**Content**	**Hours**
I	**Real Time Environment** Functional Requirements – Temporal Requirements – Dependability Requirements – Classification of Real Time Systems – Real Time System Market – Examples: Controlling the Flow in a Pipe – Engine Control – Rolling Mill. IoT: Vision – Drivers – Technical Issues –RFID Technology.	12
II	**Embedded System Components** Hardware Components: I/O Interfaces –Processor I/O Interconnection – BUS Interconnection – High & Low Speed Serial Interconnection – Memory Subsystems – Firmware Components: Boot Code – Device Drivers – Operating System Services – RTOS System Software Mechanisms – Software Application Components.	12
III	**Debugging Components** Single Step Debugging – Power on Self–Test Diagnostics – Application Level Debugging – Performance Tuning – High Availability and Reliability Design.	12
IV	**System Life Cycle** Lifecycle Overview – Requirements – Risk Analysis – High Level Design– Component Detailed Design – Component Unit Testing – System Integration – Configuration Management – Version Control– Regression Testing.	12
V	**Applications** Continuous Media Applications:Video–Video Codecs–Audio Codecs–VoIP. Robotic Media Applications: Robotic ARM – Automation and Autonomy. Computer Vision Applications: Object Tracking – Image Processing for Object Recognition – Characterizing Cameras –Stereo Vision.	12

Text Books:

1. *Sam Siewert, "Real Time Embedded Systems and Components", Cengage Learning, Delhi,Seventeenth Indian Reprint, 2013. (UnitI)*
2. *Hermann Kopetz, "Real–Time Systems: Design Principles for Distributed Embedded Applications", Springer, Second Edition, 2011. (Unit II– V)*

Reference Book:

1. *Jonathan W. Valvano, "Embedded Microcomputer Systems: Real Time Interfacing", Cengage Learning, Third Edition, 2011.*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP20B	Course Title	Batch:	2019-2020 Batch Only
		ELECTIVE II: (B) VIRTUAL INSTRUMENTATION	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

To study the basic concepts of Data Acquisition, signal Processing and Manipulation in Virtual Instrumentation.

Course Outcomes (CO)

K1	CO1	Understand the concept of virtual instrumentation.
K2	CO2	Outline the Lab VIEW software for VI and Integrate VI tool sets.
K3	CO3	Evaluate the working of data acquisition systems.
K4	CO4	Design various VI systems for automation.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	M
CO2	S	S	S	S
CO3	S	S	M	M
CO4	S	S	S	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP20B	ELECTIVE II: (B) VIRTUAL INSTRUMENTATION	IV
Units	Content	Hours
I	**Graphical System Design:** Introduction – Graphical System Design Model – Design Flow with GSD – Virtual Instrumentation – Virtual Instrument with Traditional Instrument – Hardware and Software in VI – VI for Test, Control and Design – VI in The Engineering Process – VI Beyond PC–GSD UsingLab VIEW – Graphical and Textual Programming.	12
II	**Overview of Lab VIEW**: Introduction – Advantage of Lab VIEW – Software Environment – Crating and Saving a VI – Front Panel and Block Diagram Toolbar – Palettes – Shortcut Menus – Front Panel Controls and Indicators – Block Diagram – Data Types – Data Flow Program – Lab VIEW Documentation Resources – Keyboard Shortcuts.	12
III	**Repetition & Loops**: Modular Programming in Lab VIEW – Introduction to Repetition and Loops – For and While Loop – Structures and Terminals– Shift Registers – Feedback Nodes – Control Timing – Communication Among Multiple Loops – Local and Global Variables. **Arrays:** Arrays in Lab VIEW – Creating One, Two and Multi-Dimensional Arrays – Initializing, Deleting, Inserting Replacing Elements, Rows, Columns and Pages Within Array – Clusters – Graphs andCharts.	12
IV	**Instrument Control & DAQ**: GPIB – VISA – Instrument Drivers – Serial Port Communication – Introduction to Data Acquisition – Transducers – Signals – Signal Conditioning – DAQ Hardware Configuration and Hardware – Analog Inputs and Outputs – DAQ Software Architecture – DAQ Assistant.	12
V	**Applications of VI & IMAQ Vision** Vision Basics – Image Processing and Analysis – Particle Analysis – Machine Vision – Motion Controller – Motor Amplifiers and Drives – Feedback Devices.	12

Text Book:

1. *Jovitha Jerome, "Virtual Instrumentation using LabVIEW", PHI,2010.*

Reference Books:

1. *Sanjay Gupta, Joseph John, "Virtual Instrumentation using LabVIEW", McGraw Hill, Second Edition, 2010.*
2. *LabVIEW: Basics I & II Manual, National Instruments,2005.*

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP21A	Course title	Batch:	2019-2020 Batch Only
		ELECTIVE III Practical VII: INTERNET OF THINGS	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

This course focuses on the latest microcontrollers with application development, product design and prototyping.

Course Outcomes (CO)

K1	CO1	Understand the application areas of IOT
K2	CO2	Apply the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
K3	CO3	Analyze the building blocks of Internet of Things and its characteristics.
K4	CO4	Build the IoT products for various real time applications

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	M	S	M
CO4	S	S	M	M

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP21A	ELECTIVE III Practical VII: INTERNET OF THINGS	IV

(Any 10 Experiments)

1. Starting Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
2. Displaying different LED patterns with Raspberry Pi.
3. Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.
4. Raspberry Pi Based Oscilloscope.
5. Setting up Wireless Access Point using Raspberry Pi.
6. ADC / DAC Interfacing with Raspberry Pi.
7. Ultrasonic sensor interfacing with Raspberry Pi.
8. Temperature Sensor Interfacing with Raspberry Pi.
9. Fingerprint Sensor interfacing with Raspberry Pi.
10. Raspberry Pi GPS Module Interfacing.
11. IoT based Web Controlled Home Automation using Raspberry Pi.
12. Visitor Monitoring with Raspberry Pi and Pi Camera.
13. Interfacing Raspberry Pi with RFID.
14. Building Google Assistant with Raspberry Pi.
15. Installing Windows 10 IoT Core on Raspberry Pi

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Programme Code:	MEL	Programme Title: M.Sc., (Electronics and Communication Systems)		
Course Code:	19ELP21B	Course Title	Batch:	2019-2020 Batch Only
		ELECTIVE III Practical VII: VIRTUAL INSTRUMENTATION	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective

To impart practical knowledge in programming techniques, data acquisition and interfacing techniques of virtual instrumentation and to use VI for different applications.

Course Outcomes (CO)

K1	CO1	Understand the software environment of Lab VIEW and use the programming structures and data types that exist in Lab VIEW.
K2	CO2	Create user interfaces with charts, graph and buttons.
K3	CO3	Outline the uses of data acquisition systems, analysis and display operations.
K4	CO4	Create and save VIs for industrial applications.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	M	S	M
CO4	S	S	M	L

S - Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELP21B	ELECTIVE III Practical VII:(B) VIRTUAL INSTRUMENTATION	IV

(Any 10 Experiments)

(Using Lab VIEW)

1. Creating a simple VI to place a Digital Control
2. VI to make a Degree C to Degree F Converter
3. Converting VI in to SubVI
4. To count Modulus 32 and display the values in decimal, octal andbinary.
5. Built a VI using while loop that displays random numbers in to three wave formcharts. (Strip, scope &Sweep)
6. Application using Formula Node
7. Median Filter
8. Discrete Cosine Transform
9. Convolution of Two Signals
10. Windowing Technique
11. Instrumentation Amplifier to Acquire an ECG Signal
12. Acquire, Analyze and Present an EEG using Virtual Instrumentation
13. Development of Temperature Measurement
14. Development of Virtual Instrument for Function Generator
15. Development of Virtual Instrument for Audio Signal Spectrum Analyzer

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