HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
COIMBATORE – 641 028.
SCHEME OF EXAMINATION – CBCS PATTERN
M.Sc., ELECTRONICS AND COMMUNICATION SYSTEM
(For the students admitted from the Academic year 2016–2017and onwards)

CODE No.	SUBJECT	LECTURE Hrs./WEEK	EXAM. Dur. Hrs.	Max. Marks			Credit Points
				IE	EE	Total	
First Semester							
16ELP01	Digital and Network Communication	5	3	25	75	100	4
16ELP02	Microwave and RADAR Navigation System	5	3	25	75	100	4
16ELP03	8051Microcontroller with C Programming	5	3	25	75	100	4
16ELP04	Industrial and Power Electronics	5	3	25	75	100	4
16ELP05	Practical I: Digital Communication Systems	5	5	40	60	100	4
16ELP06	Practical II: 8051 Microcontroller and its Applications	5	5	40	60	100	4
Second Semester							
16ELP07	Optical Fiber Communication	5	3	25	75	100	4
16ELP08	Mechatronics and Control Systems	5	3	25	75	100	4
16ELP09	Embedded System and RTOS	5	3	25	75	100	4
16ELP10	Digital System Design using VHDL	5	3	25	75	100	4
16ELP11	Practical III: Optical and Microwave Laboratory	4	5	40	60	100	4
16ELP12	Practical IV: Embedded System and RTOS	4	5	40	60	100	4
16GSP01	Skill Based: Cyber Security	2	–	100	–	100	2
Third Semester							
16ELP13	Mobile Communication	5	3	25	75	100	4
16ELP14	Digital Signal Processing	5	3	25	75	100	4
16ELP15	Nanoelectronics and Nanosystems	5	3	25	75	100	4
16ELP16	Modern VLSI Design	5	3	25	75	100	4
16ELP17	Practical V: DSP Laboratory	5	5	40	60	100	4
16ELP18	Practical VI: VLSI Design	5	5	40	60	100	4
Fourth Semester							
16ELP19	Elective I – (A) Wireless Sensor Networks (OR) (B) ARM Core Processor	5	3	25	75	100	4
16ELP20	Elective II – (A) Real Time System Design (OR) (B) Virtual Instrumentation	5	3	25	75	100	4
16ELP21	Elective Practical: (A) Networking Laboratory (OR) (B) Virtual Instrumentation	5	5	40	60	100	4
16ELP22	Project Work	1	–	50	150	200	4
							90

1. Breakup Marks for IE (Theory papers)

One Test	–	5 Marks
Model Exam	–	10 Marks
Assignments	–	5 Marks
Seminar	–	5 Marks
Total	–	25 Marks

Question Paper Pattern for IE test I (for 50 Marks) (2 hours)

Section–A (18 Marks) **3 x 6=18 Marks**
Answer **ALL** Questions
Either or Type
ALL questions carry EQUAL Marks
Section–B (32 Marks) **2 x 16=32 Marks**
Answer any **TWO** Questions out of three questions.
ALL questions carry EQUAL Marks

Total 50 Marks

Question Paper Pattern for IE Model Exam (for 75 Marks) (3 hours)

Section–A (30 Marks) **5 x 6 =30 Marks**
Answer **ALL** Questions
One Question from each unit with **Either or Type**
ALL questions carry EQUAL Marks
Section–B (45 Marks) **3 x 15=45 Marks**
Answer any **THREE** Questions out of five questions.
ALL questions carry EQUAL Marks

Total 75 Marks

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			*I. E*		
Work Diary	25	–	a) Attendance Marks	20	
Report	50	50	b) Review Marks	30	50
Viva –voce	25	50			
Examination					
Total	**100**	**100**			
			E.E[*1]		
			a) Final Report Marks	120	
			b) Viva–voce Marks	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 = 40Marks
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 (for 75 Marks) (3 hours)

Section–A (30 Marks) **5 x 6=30 Marks**
Answer **ALL** Questions
One Question from each unit with **Either or Type**
ALL questions carry EQUAL Marks

Section–B (45 Marks) **3 x15=45 Marks**
Answer any **THREE** Questions out of five questions.
ALL questions carry EQUAL Marks

Total 75 **Marks**

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Code No	Subject	Semester No
16ELP01	DIGITAL AND NETWORK COMMUNICATION	I
Objective:	To enrich the basics of Digital and Network Communication Techniques to the Students.	

Units	Topics	Hours
Unit 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
Unit 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
Unit III	**Data Communication** Introduction – Basic Terms and Concepts – Line Configurations – Topology – Transmission Media – MODEM: Standard and Types – Analog and Digital transmission: Encoding and Modulating – Channel Capacity – Base Band and Broad Band – Transmission Impairments – Multiplexing: FDM – TDM – Error Detection and Control: CRC.	10
Unit IV	**Network Architecture and Protocols** Layered Architecture – OSI model – Functions of Layers – Data Link Control Protocols – ARQ – Stop and Wait – Sliding Window – Go back N and Selective Repeat – Asynchronous Protocol: X Modem – Y Modem– Kermit – Synchronous Protocol: BSC– SDLC – HDLC– TCP/IP Model – SMTP – HTTP – FTP.	12
Unit 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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Code No	Subject	Semester No
16ELP02	MICROWAVE AND RADAR NAVIGATION SYSTEM	I
Objective:	To enable the Students to learn the operations of Microwave Devices & Circuits and to get deep Knowledge in RADAR and its Navigation Systems.	

Units	Topics	Hours
Unit 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 –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.	12
Unit 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
Unit 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
Unit IV	**Microwave Antennas** 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
Unit 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: 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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Code No	Subject	Semester No
16ELP03	8051 MICROCONTROLLER WITH C PROGRAMMING	I
Objective:	To enable the Students to learn the Instruction Set, Programming and Interfacing concepts of 8051 Microcontroller.	

Units	Topics	Hours
Unit 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
Unit 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
Unit III	**Programming with C** Data Types – Time Delay Programming – I/O Programming – Logic Operations – Arithmetic Operations – Timer Programming – Counter Programming.	12
Unit 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
Unit 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 Gillispie Mazidi 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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Code No	Subject	Semester No
16ELP04	INDUSTRIAL AND POWER ELECTRONICS	I
Objective:	To impart the Knowledge of different types of Power Semiconductor Devices and their Switching Characteristic Applications to the Students.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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.	13
Unit 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.	11
Unit 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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Code No	Subject	Semester No
16ELP05	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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Code No	Subject	Semester No
16ELP06	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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Code No	Subject	Semester No
16ELP07	OPTICAL FIBER COMMUNICATION	II
Objective:	To facilitate the Knowledge about Optical Fiber Fabrication, Optical Sources & Detectors and its Transmission Techniques to the Students.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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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Code No	Subject	Semester No
16ELP08	MECHATRONICS AND CONTROL SYSTEMS	II
Objective:	To introduce the concepts of Mechatronics, Transducers & Signal Conditioning Systems and also import the Knowledge on various Actuation Systems Response & concept of PLC to the Students.	

Units	Topics	Hours
Unit I	**Sensors & Transducers** Introduction to Mechatronic Systems – Sensors and Transducers: Performance Terminology – Static and Dynamic Characteristics – Displacement, Position and Proximity Sensors – Velocity and Motion Sensors – Liquid Flow – Temperature and Light Sensors – Selection of Sensors.	10
Unit II	**Signal Conditioning and Data Presentation Systems** Signal Conditioning – Op–Amps in Signal Conditioning – Protection and Filtering – Compensation Techniques – Digital Signals – D to A and A to D Conversion: Types – Multiplexers – Data Acquisitions – Digital Signal Processing and Pulse Modulation–Data Presentation Elements – Data Acquisition and Measurement System.	15
Unit III	**Dynamic Responses, Transfer Function and Frequency Response of a System** Modeling Dynamic Systems – Transfer Functions of a System – First and Second Order Systems – System in Series – System with Feedback Loops– Frequency Response of System – Bode Plots– Stability – Control Modes – Two Step Mode – Proportional Mode – Derivative and Integral Control – PID and Digital Controllers – Velocity and Adaptive Control – Controller Tuning.	12
Unit IV	**Programmable Logic Controller (PLC)** Basic Structure – Input / Output Processing – Programming – Mnemonics– Timers, Internal Relays and Counters – Shift Registers – Master and Jump Controls – Data Handling – Analogue Input / Output – Selection of PLC – Traditional and Mechatronic Design.	13
Unit V	**Overview of MEMS and Microsystems** MEMS and Microsystems – Typical MEMS and Microsystem Products – Evolution of Microfabrication – Microsystems and Microelectronics – Multidisciplinary Nature of Microsystem Design and Manufacture – Microsystems and Miniaturization – Applications: Automotive Industry – Health Care Industry – Aerospace Industry – Industrial Products – Consumer Products – Telecommunications.	10

Text Books:

1. *William Bolton "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" Pearson Education Publishers, New Delhi, Fourth Edition, 2014.*
2. *Tai–Ran–Hsu, "MEMS & Micro Systems Design and Manufacture",TMH, 2002.*

Reference Books:

1. *Frank D. Petruzella, "Programmable Logic Controllers", Tata McGraw Hill, Third Edition, 2010.*
2. *Verma. S.N, "Automatic Control Systems", Khanna Publishers.*
3. *Robert H. Bishop, "The Mechatronics Hand Book", CRC Press, 2002.*

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Code No	Subject	Semester No
16ELP09	EMBEDDED SYSTEM AND RTOS	II
Objective:	To enable the Students to understand the various Embedded RTOS and to study the Architecture of PIC Microcontroller to develop applications in Embedded System.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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 Data Sheet.*

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Code No	Subject	Semester No
16ELP10	DIGITAL SYSTEM DESIGN USING VHDL	II
Objective:	To import the concepts of digital circuit design using VHDL and equip the students to develop new digital systems.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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
Unit IV	**Programmable Logic Devices** Overview of PLD – Simple Programmable Logic Devices – Complex Programmable Logic Devices (CPLD) – Field Programmable Gate Arrays (FPGA).	12
Unit 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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Code No	Subject	Semester No
16ELP11	PRACTICAL III: OPTICAL AND MICROWAVE LABORATORY	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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Code No	Subject	Semester No
16ELP12	PRACTICAL IV: EMBEDDED SYSTEM AND RTOS	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 Multitasking.
15. Temperature Monitoring and Control.

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Code No	Subject	Semester No
16ELP13	MOBILE COMMUNICATION	III
Objective:	To make the Student familiar with the Cellular Concept, Design and Wireless Network.	

Units	Topics	Hours
Unit 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
Unit 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
Unit III	**Multiple Access Techniques** Multiple Access: FDMA – TDMA –SSMA – SDMA – Packet Radio: Protocols – CSMA – Reservation – Capture Effect – Capacity of Cellular Systems: Cellular CDMA.	12
Unit 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 Access.	12
Unit 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. *Gottapu Sasibhushana 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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Code No	Subject	Semester No
16ELP14	DIGITAL SIGNAL PROCESSING	III
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.	

Units	Topics	Hours
Unit 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.	12
Unit 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
Unit 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.	11
Unit 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
Unit 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).	13

Text Books:

1. *Farooq Husain, "Digital Signal Processing", Umesh Publications, 3rd Edition, 2012.*
2. *Salivahanan . S, Vallavaraj. A, Gnanapriya. C, "Digital Signal Processing", Tata McGraw–Hill Publishing Company Limited, 13th Reprint, 2004.*

Reference Book:

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

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Code No	Subject	Semester No
16ELP15	NANOELECTRONICS AND NANOSYSTEMS	III
Objective:	To make the Students familiar in the idea of Nanoelectronics and its implications in the Nano System Design.	

Units	Topics	Hours
Unit 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
Unit 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 – Electron Spin Transistor – Quantum Cellular Automata – Quantum Dot Array.	12
Unit 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
Unit 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 and FET Circuit Design.	12
Unit 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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Code No	Subject	Semester No
16ELP16	MODERN VLSI DESIGN	III
Objective:	To equip the Students to learn about the Modern VLSI and other Advanced IC Design process.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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 Bus Design.	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.(Unit V)*

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Code No	Subject	Semester No
16ELP17	PRACTICAL V: DSP LABORATORY	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. Image – Zooming and Shrinking

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Code No	Subject	Semester No
16ELP18	PRACTICAL VI: VLSI Design	III

(Any 10 Experiments)

(Using Digital ICs / VHDL / Lab VIEW)

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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Code No	Subject	Semester No
16ELP19	ELECTIVE I: (A) WIRELESS SENSOR NETWORKS	IV
Objective:	To equip the Students in Sensor Node essentials, Architectural details, Medium Access, Routing Issues and the Energy Constrained Operational Scenario.	

Units	Topics	Hours
Unit 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
Unit 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 of Mobility.	12
Unit 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 Wireless Internet.	12
Unit 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
Unit 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, Meghadoot Architecture.	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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Code No	Subject	Semester No
16ELP19	ELECTIVE I: (B) ARM CORE PROCESSOR	IV
Objective:	To enable the Students to have familiar with an ARM Embedded System, techniques of interfacing ARM Processor & Peripherals devices related to Embedded System.	

Units	Topics	Hours
Unit 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
Unit 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
Unit 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
Unit IV	**ARM7TDMI MCU (Analog Devices ADUC7128/29)** 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
Unit V	**Hardware Configuration** ADC – DAC – Oscillator and PLL – PWM – General Purpose I/O– Serial Port MUX – UART Serial Interface – I^2C – Timer Life Time– General Purpose Timer – Wake Up Timer – Watch Dog Timer – 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 ADuc7128/29).*

Reference Book:

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

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Code No	Subject	Semester No
16ELP20	ELECTIVE II: (A) REAL TIME SYSTEM DESIGN	IV
Objective:	To enable the Students to design a real–time computer systems of their own.	

Units	Topics	Hours
Unit 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
Unit 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
Unit III	**Debugging Components** Single Step Debugging – Power on Self–Test Diagnostics – Application Level Debugging – Performance Tuning – High Availability and Reliability Design.	12
Unit 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
Unit 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. (Unit I)*
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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Code No	Subject	Semester No
16ELP20	ELECTIVE II: (B) VIRTUAL INSTRUMENTATION	IV
Objective:	To study the basic concepts of virtual Instrumentation in LAB VIEW Programming and to learn the concepts of Data Acquisition, signal Processing and Manipulation.	

Units	Topics	Hours
Unit 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 Using Lab VIEW – Graphical and Textual Programming	12
Unit 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
Unit 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 and Charts.	12
Unit 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
Unit 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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Code No	Subject	Semester No
16ELP21	ELECTIVE PRACTICAL: (A) NETWORKING LABORATORY	IV

(Any 10 Experiments)

1. Inside a PC and a MAC.
2. Installing O.S for hardware and basic software for networking.
3. Connecting different storage media to Computers and their usage.
4. Study of basic recording of sound using a P.C and Microphones.
5. Networking of Computers and trouble shooting
6. Working on Protocols.
7. Study of DOS and Windows commands.
8. Implementation of Error Detection / Error Correction Techniques.
9. Implementation of Stop and Wait Protocol and sliding window.
10. Implementation and study of Goback–N and selective repeat protocols.
11. Implementation of High Level Data Link Control.
12. Study of Socket Programming and Client – Server model.
13. Write a socket Program for Echo/Ping/Talk commands.
14. To create scenario and study the performance of network with CSMA / CA protocol land compare with CSMA/CD protocols.
15. Network Topology – Star, Bus, Ring.

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Code No	Subject	Semester No
16ELP21	ELECTIVE PRACTICAL: (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 Sub VI
4. To count Modulus 32 and display the values in decimal, octal and binary.
5. Built a VI using while loop that displays random numbers in to three wave form charts. (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, Analyse 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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