H.K.E.SOCIETY'S

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, GULBARGA

Electronics and Instrumentation Engineering Branch

(Applicable for 2019-20 admitted batch)

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER

Code No.	**Course**	**Hours / Week**					**Maximum Marks**		
		Lecture	**Tutorial**	**Self Study**	**Practical**	**Credits**	**CIE**	**SEE**	**Total**
SEMESTER V									
THEORY									
19EI51	ARM Processor	03	02		00	04	50	50	100
19EI52	Process Control	03	00	0.5	00	03	50	50	100
19EI53	Communication Systems	04	00		00	04	50	50	100
19EI54	Biomedical Instrumentation	03	00		00	03	50	50	100
19EI55	Scientific and Analytical Instrumentation	04	00		00	04	50	50	100
19HU01	Recruitment Process Training-I	00	02		00	01	50	50	100
PRACTICAL									
19EIL51	Biomedical Instrumentation Lab	00	00		02	01	50	50	100
19EIL52	ARM Processor Lab	00	00		02	01	50	50	100
19EIL53	Measurement and DSP Lab	00	00		02	01	50	50	100
					TOTAL	**22**	**450**	**450**	**900**

Course Title: ARM Processor		
Course Code	19EI51	CIE: 50
Number of Lecture Hours/Week	3 Hrs (Theory) +2 Hrs (Tutorials)	SEE: 50
Total Number of Lecture Hours : 52 Hrs	Credits: 04	SEE Hours:03

Prerequisite: Microprocessor (16EI44).

Course Objectives

1.To understand the principles and design of ARM processor.

2.To study the introduction of the novel compressed instruction format called 'Thumb' which reduces cost and power dissipation in systems.

3.To understand the significant steps in performance with series of ARM7,ARM8,ARM9,ARM10 and Strong arm processor cores.

4. To study the state of art software development and debugging environment.

5. To study embedded applications based on ARM processor cores.

Modules	Teaching Hours
Module I **An Introduction to Processor Design:** Processor Architecture and organization, Abstraction in Hardware Design,MU0- a -Simple Processor, instruction set Design, Processor Design , Trade-offs, The Reduced Instruction Set Computer, Design for low Power Consumption, Examples and Exercises. The ARM Architecture: The Acorn RISC Machine, Architecture Inheritance, The ARM Programmer's Model, ARM Development Tools.	. **10 Hrs**
Module II **ARM Assembly Language Programming:** Data Processing Instructions, Data Transfer Instructions, Control Flow Instructions, Writing Simple Assembly Language Programs, Examples and Exercises. **ARM Organization and Implementation**: 3-stage Pipeline ARM Organization, 5-stage Pipeline ARM Organization, ARM Instruction Execution, ARM Implementation, The ARM Coprocessor Interface.	**09 Hrs**
Module III **The ARM Instruction Set**: Introduction, Exceptions, Conditional Execution, Branch and Branch with link (B, BL),Branch and exchange (BX, BLX), Software Instructions like Multiply, Count Leading Zeros (CLZ- architecture v5T only), Single Word and Unsigned Byte Data Transfer , Half word and Signed Byte Data Transfer , Multiple Register Transfer, Swap Memory and Register (SWP), Status Register to General Register Transfer, General Register to Status Register Transfer Instructions, Coprocessor Instructions, Data Operations, Data Transfer, Register Transfer, Breakpoint Instruction (BKPT-Architecture v5T Only), Unused Instruction Space. Memory Faults, ARM Architecture Variants, Example and Exercises. Architecture Support for High-level Languages: Abstraction in software Design, Data and floating types, ARM floating point architecture, Expressions, Conditional Statements, loops, function and procedures, Use of Memory , Run-time environment.	**13 Hrs**
Module IV **The Thumb Instruction Set**: The Thumb bit in the CPSR, The Thumb Programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, Thumb single register data transfer instructions, Thumb multiple	

register data transfer instructions, Thumb breakpoint instruction, Thumb implementation, Thumb applications. **Architectural Support for System Development**: The ARM memory interface, The advanced microcontroller bus architecture (AMBA), Hardware system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, Embedded Trace, Signal processing support.	**09 Hrs**
Module V **ARM processor cores:** ARM7TDMI, ARM8, ARM9TDMI, ARM10TDMI, ARMCPU cores, ATM710T, ARM720T and ARM740T, ARM810, the Strong ARM SA-110, the ARM920Tand ARM940T. **Embedded ARM Applications:** The VLSI Ruby II Advanced Communication Processor, VLSI ISDN Subscriber Processer, One C^{TM} VWS22100 GSM Chip, Ericsson-VLSI Bluetooth Baseband controller, ARM7500 and ARM7500FE, AR7100, SA-1100.	**11 Hrs**

Question paper pattern:
Total 10 questions will be asked. Two from each module. The student has to answer five questions selecting at least one from each module.

Text books:
1.ARM System on Chip Architecture -Steve Furber-Pearson Publication, 2016.978-0750682763.
2.ARM System Developers Guide -Designing and Optimizing System Software- Andrew Sloss, Dominic Symes, Chris Wright, ELSEVIER.
3.The Definitive Guide to the ARM Cortex -M Joseph Yiu, Newness, ELSEVIER.

Reference Books:
1. LPC 214x User manual (UM10139) :- www.nxp.com
2. LPC 17xx User manual (UM10360) :- www.nxp.com
3. ARM architecture reference manual : - www.arm.com

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI51	**CO1**	Demonstrate the basic principles of processor architecture to achieve design objectives.
	CO2	Use Thumb instructions to execute standard ARM instructions within the processor.
	CO3	Demonstrate the architecture and performance of various series ARMs like, ARM7, ARM8, ARM9, ARM10.
	CO4	Develop the state of art software and debugging of ARM processor.
	CO5	Design several ARM based 'system on chips'.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3		3
CO2	3	3		2									3	1	3
CO3	3	3	2	1									3	1	3
CO4	3	3	3	3									3	1	3
CO5	3	1	1										3		3

Course Title: Process Control		
Course Code	19EI52	CIE: 50
Number of Lecture Hours/Week	03 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours:03
Prerequisite: Process Measurement Techniques and Instrumentation and Control Systems		

Course Objectives

Make the students to understand:

1. Fundamental characteristics and parameters used in process control.
2. Basic types of controller modes.
3. Designing of basic analog controllers and their tuning.
4. Properties of fluids.
5. Types of control valves.

Modules	Teaching Hours
Module I **Introduction to process control**: Introduction, control system principle, block diagram of process control system, PI&D diagrams. **Final control elements**: Introduction, final control operation, Signals conversion: Analog signals, digital signals, and pneumatic signals. Actuators: Electric, pneumatic & hydraulic. Control elements: Mechanical, electrical, fluid valves. **Process Characteristics**: Introduction, process equation, process load, process lag, self regulation. Control system parameters: Error, variable range, control parameter range, control lag, dead time and cycling.	**09 Hrs**
Module II **Control modes**: Introduction. Discontinuous controller modes: Two position mode, multi position mode, floating control mode. Continuous controller modes: Proportional controller, Integral controller, derivative controller, proportional-integral controller, proportional-derivative controller & proportional-integral-derivative controller modes. **Analog Controllers**: Introduction, General features, Electronic controllers: Error detector, Single mode, composite controller mode. Pneumatic controller: General features, mode implementation, design considerations.	**08Hrs**
Module III **Control loop Characteristics**: Introduction, control system configurations: Single variable, Cascade control system. Multivariable control system: Analog control, supervisory & direct digital control. Control system quality: Definition of quality, measure of quality. Stability: Transfer function frequency dependence, stability criteria. **Process loop Tuning**: Introduction, open loop transient response method, Ziegler-Nichols method, Frequency response method.	**08 Hrs**

Module IV **Fluid Power Fundamentals:** Fundamental Principles of Hydraulics, Concepts of fluid in motion, Laminar and turbulent flow Essential properties of hydraulic fluids, Overview of characteristics of various hydraulic oils Introduction to a basic hydraulic systems and realization of pump as the power source.	**08 Hrs**
Module V (Self Study) **Pressure and Flow Control Valves :** Pressure Relief Valves- Direct acting relief valve, Pilot operated relief valve, Poppet relief valve; Pressure sequence valve, Pressure reducing valve, Unbalanced valve, Counterbalance valve, ANSI Symbols. Non-Return valve, Fundamental concept of flow control, Flow regulation valve (Pressure drop compensated and non-compensated), Positioning of a flow control valve (Meter-in, Meter-Out, Bleed-Off), ANSI Symbols.	**09 Hrs**

Question paper pattern:
Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:
1. Process Control Instrumentation Technology-C .Johnson 4th edition.'
2. Oil Hydraulic Systems: Principles and Maintenance, S. R. Majumdar, Tata McGraw Hill Education Pvt. Ltd., ISBN – 0-07-463-748-7.

Reference Books:
1. Process Control, Instrument Engineers Handbook -Bela G Liptak.
2. Process System Analysis and Control -Donald R Coughanowr,– McGraw Hill.
3. Hydraulic and Pneumatic Controls: Understanding Made Easy -K. S. Sundaram- S. Chand and Company Ltd., ISBN – 81-219-2635-1.
4. Pneumatic and Hydraulic Systems-W. Bolton -Butterworth Heinemann, ISBN – 0-07-506-383-62.
5. Hydraulics and Pneumatics -A Technician's and Engineer's Guide-A. Parr-Butterworth Heinemann, ISBN – 0-08-096-674-8.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI52	**CO1**	Define and describe the basic principles and terminologies used in process control system.
	CO2	Classify and discuss various types of control elements and loops.
	CO3	Illustrate various types of controller modes and their tuning methods.
	CO4	Classify the control loops and design the basic analog controllers.
	CO5	Enumerate hydraulic oil properties and describe pressure and flow valves.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3		
CO2	3	3		2									3	1	
CO3	3	3	2	1									3	1	
CO4	3	3	3	3									3	1	
CO5	3	1	1										3		

Course Title: Communication Systems		
Course Code	19EI53	CIE: 50
Number of Lecture Hours/Week	04 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 52	Credits: 04	SEE Hours: 03
Prerequisite: Signals and Systems.		

Course Objectives

1. To understand about the communication systems and associated noise.
2. To study the different methods of amplitude modulation and demodulation.
3. To study the different methods of frequency modulation and demodulation
4. To understand the sampling process and generation and detection of various pulse modulation methods.
5. To understand the various digital modulation schemes.

Modules	Teaching Hours
Module I **Introduction to Communication Systems:** Information, Transmitter, Channel-Noise, Receiver, Description and need for Modulation, Noise: External noise, Internal noise, Noise calculations, Noise figure, Noise temperature.	**10 Hrs**
Module II **Amplitude Modulation:** Amplitude Modulation theory, Generation of AM, Basic requirements, Grid modulation, plate modulation, cathode modulation, collector modulation, square law diode modulation, Suppression of carrier, Balanced modulation, Suppression of unwanted sideband : Filter method, phase shift method. Demodulation: square law diode detector, linear diode detector, Coherent detection. Signal to noise ratio for Coherent detection, Noise in AM receivers using envelope detection, Threshold effect, numerical.	**11Hrs**
Module III **Frequency Modulation:** Theory of Frequency and Phase Modulation, Generation of FM: Basic reactance modulator, varactor diode method, Armstrong method. Demodulation:, Ratio detector, Time division multiplexing ,frequency division multiplexing Noise in FM reception, FM threshold effect, Pre-emphasis and De-emphasis in FM.	**10 Hrs**
Module IV **Pulse Modulation:** Sampling Theorem: Low pass signals, band pass signals. Natural sampling, flat top sampling, signal recovery through holding, quantization of signals, quantization errors. Introduction to Pulse Modulation, Types of Pulse Modulation, Generation and Demodulation of PAM, PWM, PPM, PCM . Differential PCM, delta Modulation, Adaptive delta Modulation, Telemetry.	**10 Hrs**
Module V **Digital Modulation Techniques:** Introduction, binary phase shift keying, differential phase shift keying, differentially encoded PSK, quadrature phase	**11 Hrs**

shift keying, M-ary PSK, quadrature amplitude shift keying, binary frequency shift keying, similarity of BFSK and BPSK, M-ary FSK, minimum shift keying, noise in digital modulation schemes. Methods of Binary data transmission [RZ, NRZ (Unipolar, Bipolar) AMI, BIO, NRZ(S), NRZ(M)].	

Question paper pattern:
Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:
1. Electronic Communication Systems: GEORGE KENNEDY, 3rd Edn, TMH.
2. Principles of Communication Systems: TAUB SCHILLING, 2nd Edn, TMH.

Reference Books:
1.Analog communication systems- K. SAM SHANMUGAM, John Wiley.
2.An Introduction to Analog and Digital Communication- SIMON HAYKIN, John Wiley and Sons.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI53	**CO1**	Describe basic aspects of communication systems and differentiate various noises involved.
	CO2	Discuss the various amplitude modulation and demodulation techniques.
	CO3	Demonstrate the knowledge of various frequency modulation and demodulation techniques.
	CO4	Define sampling theorem and discuss quantization, with various pulse modulation and demodulation Techniques.
	CO5	Apply different digital modulation and demodulation techniques in digital communication and discuss various methods of binary data transmission.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									2	3	3
CO2	3	2	1	1									1	3	3
CO3	3	2	1	1									1	3	3
CO4	3	2	1	1									1	3	3
CO5	3	2	1	1									2	3	3

Course Title: Biomedical Instrumentation		
Course Code	19EI54	CIE: 50
Number of Lecture Hours/Week	03 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours: 03
Prerequisite: Transducers and Instrumentation (15EI35)		

Course Objectives

The students are made to understand:

1. Different sources of biomedical signals.
2. Different biomedical signal recorders.
3. About the blood flow and cardiac output measurements.
4. Operation of cardiac pacemakers, defibrillators and therapeutic equipments.

Modules	Teaching Hours
Module I **Fundamental Concepts:** Sources of biomedical signals, Basic medical instrumentation system, performance requirements of medical instrumentation systems, PC based medical instruments, General constraints in design of medical instrumentation systems. Bioelectric Signals and Electrodes: Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG) and Electrodes for ECG, EEG, EMG.	**09 Hrs**
Module II **Recorders: Electro cardiogram**: Review of Heart Structure & Function, Conduction System of the heart, Electrical activity of the heart, Genesis & characteristics of Electrocardiogram (ECG), Electrocardiogram (ECG), Characteristics of the normal ECG, Cardiac arrhythmias and their electrocardiographic interpretation-Abnormal sinus rhythms, Premature contractions, description of an Electrocardiograph, ECG lead system, ECG recorder. **Electroencephalograph**: Genesis of Electroencephalogram (EEG), Block diagram description of an Electroencephalograph, 10-20 electrode systems, and computerized analysis of EEG.	**09 Hrs**
Module III **Blood Flow And Cardiac Output Measurement:** Measurement of blood pressure Direct & Indirect method measurement of systolic, diastolic blood pressure, Detection of Kortokoff sounds, Laser Doppler flow meters. Cardiac output measurement: Indicator dilution method, Dye dilution method. Thermal dilution techniques, Measurement of continuous cardiac output derived from the aortic pressure waveform, Impedance technique.	**08 Hrs**
Module IV **Cardiac Pacemakers And Defibrillators:** Need for cardiac pacemaker, External	

pacemaker, Implantablepacemaker, Ventricular synchronous demand pacemaker, Programmable pacemaker, Rate-responsive pacemakers, Packaging, Power sources, Leads & electrodes and their problems. Defibrillators-Need, DC defibrillator Electrodes, DC defibrillator with synchronizer, Automatic external defibrillator, Implantable defibrillator, Defibrillator analyzer	**08 Hrs**
Module V **Bio Telemetry& Physiotherapy Equipments:** Biomedical Telemetry & Telemedicine: Wireless telemetry, single channel telemetry, multi-patient telemetry, implantable telemetry and telemedicine. High frequency heat therapy, short wave, microwave diathermy, ultrasonic therapy unit, electro diagnostic therapeutic aperatus, pain relief through electrical simulation.	**08 Hrs**

Question paper pattern:
Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:
1.Hand book of Biomedical Instrumentation- R. S. Khandpur- 2ndEdition, Tata McGraw Hill, 2003.
2.Biomedical Instrumentation and Measurement- Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer, 2nd Edition, Prentice-Hall India Pvt. Ltd., 2004.

Reference Books:
1. Medical Instrumentation Application & Design, John G. Webster, 3rdEdition, John Wiley & Sons/Wiley Student Edition, 2001.
2. Principals of applied Biomedical instrumentation, LESLEY CROMWELL & OTHERS, John Wiley and sons, 2nd edition.
3. Introduction to Biomedical equipment technology, JOSEPH J CARR, JOHN M BROWN, Prentice hall of India, 4th Edition

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI54	**CO1**	Demonstrate the concept of biomedical signals, medical instruments and bio potential electrodes.
	CO2	Explain the characteristic of ECG,EEG, and concept of recorders.
	CO3	Demonstrate the principle of Blood pressure and blood flow and cardiac output measurement.
	CO4	Describe the concept of cardiac pacemakers and defibrillators.
	CO5	Describe the principle of assist devices, therapeutic equipment and biotelemetry.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	1	
CO2	3												3	2	
CO3	3												3	1	
CO4	3	2	3										3	1	
CO5	3	1											3	1	

Course Title: Scientific and Analytical Instrumentation		
Course Code	19EI55	CIE: 50
Number of Lecture Hours/Week	04 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 52	Credits: 04	SEE Hours: 03
Prerequisite: Engineering Physics, Chemistry.		
Course Objectives Students will come to know: 1. About various analytical instruments like spectroscope and chromatographs. 2. About electromagnetic rays used in spectroscopes and separation methods in chromatographs. 3. About various analysis used by different spectroscopes. 4. About different spark and arc sources used as AC and DC.		
Modules		**Teaching Hours**
Module I **Introduction:** Classification of analytical methods and Instrumental Techniques Electromagnetic radiation, electromagnetic spectrum, Atomic energy levels, molecular energy levels, vibrational energy levels, Electromagnetic radiation properties, Emission of radiation, absorption of radiation. **UV and visible spectroscopy:** Fundamental laws of photometry, Radiation sources: Xenon arc lamp, H_2 or D_2 lamp, tungsten lamp, Nerst glower devices, wave length selection, sample handling. **Detectors:** Photographic plate, photomultiplier tube, phototube, photocell silicon diode. Different types of detectors, readout devices. Instruments for absorption photometry, spectrophotometry.		**10 Hrs**
Module II **X-ray Methods:** Generation of x-rays: x-ray absorption, fluorescence, diffraction, Bragg's law. Instrumentation; x-ray source; generating equipment, selection, Detectors: Gas filled, semiconductor and scintillation detectors. Pulse height analyzer, Application of diffraction, quantitative and qualitative analysis.		**10 Hrs**
Module III **Mass spectroscopy:** Types of mass spectroscopy: Atomic and molecular components of mass spectrometer, Instrumentation: sources, mass analyzers: Electron multipliers, Faraday cup, qualitative and quantitative applications. **Infrared Spectroscopy:** Introduction, theory of IR : Instrumentation Sources; Nerst glowers, mercury arc, incandescent, tungsten lamps, Transducers: electric and photoconductivity, Fourier-Transform IR (FTIR).		**10 Hrs**
Module IV **Chromatography:** Classification, Column; its efficiency, resolution,		

partition forces, partition co-efficient. Migration rates of solutes; distributions constants and retention time. **Gas Chromatography:** Principles, schematic of gas chromatograph. Instrumentation: gas supply, Sample injection, column configuration. Detectors: Flame ionization, thermal conductivity. Atomic emission. High performance liquid chromatography: scope; Instruments for liquid chromatography.	**10 Hrs**
Module V **Automatic Emission and Absorption Spectroscopy:** Hollow cathode lamp, electrode discharge lamps. Instrumentation: Single beam and double beam techniques.Plasma and arc and spark sources. **NMR Spectroscopy:** Theory of NMR, classical description of NMR, types of NMR spectra, chemical shift, spin-spin coupling, spin-spin splitting. **Instrumentation:** Fourier transform NMR spectrometer applications.	**12 Hrs**

Question paper pattern:
Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:
1. Instrumental Method of Analysis-Willard H.W. Merritt, L.L. Dean J.A**,** Sehie F.A.
2. Principles of Instrumental Analysis -Skoog, Holler, Nieman-5th Edition.

Reference books:
1. Instrumental Methods of Chemical Analysis -G.W. Ewing
2. Instrumental methods of Chemical Analysis -Chatwal and Anand

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI55	**CO1**	Describe various basic properties of electromagnetic rays and electromagnetic spectrum.
	CO2	Explain basic elements such as sources, monochromators and detectors used spectroscopes**.**
	CO3	Analyze mass of the sample by mass spectroscope.
	CO4	Separate various samples by different chromatographs.
	CO5	Analyze various samples by different spectroscopes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			2	3							2	3	1	
CO2	2	2		2	3							2	2	2	
CO3	3	1		2	3							1	3	1	
CO4	2			2								1	2	1	
CO5	2	2			2							1	2	1	

Course Title: Recruitment Process Training-I		
Course Code	19HU01	CIE: 50
Number of Lecture Hours/Week	02 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 28	Credits: 0:2:0:1	SEE Hours: 03
Topics		
Quantitative aptitude		**Teaching Hours**
Divisibility Rules and Unit Digit Simple Equations Ages LCM and HCF Ratio, Proportion and Variations Remainder Theorem Permutations and Combinations Progressions		12 Hrs
Verbal aptitude		
Reading Comprehension Synonyms and Antonyms Subject Verb Agreement Verbal Analogies Verbal Sequence		08 Hrs
Reasoning Aptitude		
Analytical Reasoning Blood Relation Direction Sense		03 Hrs
Soft skills		
Communication Skills Presentation Skill Interview Skills Resume Skills.		05 Hrs

Course Title: Biomedical Instrumentation Lab		
Course Code	19EIL51	CIE: 50
Number of Practical Hours/Week	02 Hrs (Practical)	SEE: 50
	Credits: 01	SEE Hours: 03

Prerequisite: Biomedical Instrumentation (15EI52)

Course Objectives

1. To understand the concepts of ECG signal acquisition.
2. To measure blood pressure and respiration parameters.
3. To understand the concepts of EEG signal.
4. To understand the concepts of EMG signal.
5. To measure heart sounds and hearing loss.

List of Experiments

1. Design an Instrumentation amplifier for given gain.
2. Experiment on acquisition of ECG signal.
3. Experiment on acquisition of EEG signal.
4. Experiment on acquisition of EMG signal.
5. Blood pressure measurement using sphygmomanometer.
6. Experiment on plethysmograph system.
7. Experiment on acquisition of phono-cardiogram signal.
8. Experiment on Audiometer.
9. Measurement of ECG parameters.
10. Experiment on acquisition of respiration signal & measurement of respiration parameters.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EIL51	**CO1**	Design a instrumentation amplifier.
	CO2	Conduct the experiment to acquire ECG, EEG and EMG signals.
	CO3	Conduct experiments on sphygmomanometer and plethysmographsystem.
	CO4	Conduct experiments on phonocardiogram and audiometer system.
	CO5	Measure the ECG and respiration parameters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3						2	1		2	2	3	
CO2	3	3				2			2	1		1	2	3	
CO3	3	3				2			2	1		1	2	3	
CO4	3	3				2			2	1		1	2	3	
CO5	3	3		3		2			2	1		1	2	3	

Course Title: **ARM Processor Lab**		
Course Code	19EIL52	CIE: 50
Number of Practical Hours/Week	2 Hrs (Practical)	SEE: 50
	Credits: 01	SEE Hours:03

Prerequisite: Microprocessor Lab (16EI48)

Course Objectives

1. To understand the architecture of ARM microprocessor.
2. To implement data transfer techniques.
3. To implement arithmetic and logical operations.
4. To implement branch modifying instructions in programming
5. To perform interfacing operations with various peripheral devices.

List of Programs

1. WAP to find the length of a null terminal string.
2. WAP to sort an array in 32-bit numbers in ascending and descending order.
3. WAP to seen a series of 32-bit numbers to find how many are negative.
4. WAP to convert the numbers of ones and zeros in two consecutive memory locations.
5. WAP to find the sum of first 10 integer numbers.
6. Write a C- language program to interface DC motor and rotate in clockwise direction.
7. Write a C- language program for turning Buzzer ON/OFF with a delay.
8. Write a C- language program for blinking 8 LED's.
9. Write a C- language program to turn relay ON/OFF with a delay in array.
10. Write a C- language program to interface stepper motor and rotate in clockwise direction
11. Write a C- language program to interface a DAC and generate triangular waveforms.
12. Write a C- language program to display the Hexa digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**
19EIL52	**CO1**	Develop fundamental assembly language programs on various arithmetic and logical operations.
	CO2	Employ various single and multiple data transfer instructions in programs.

	CO3	Develop the programs using thumb data processing instructions.
	CO4	Develop the programs to interface with peripheral devices.
	CO5	Demonstrate the programming proficiency with real time measurements.
(Minimum of 12 programs have to be executed)		

Assembly language programs-05
C- language programs-07

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	2									1			2	3	
CO3	2		2						1				2	2	
CO4	2	1							1	2			2	1	
CO5	3	2								1			3		

Course Title: Measurement and DSP lab		
Course Code	19EIL53	CIE:50
Number of Practical Hours/Week	02 Hrs (Practical)	SEE: 50
	Credits: 01	SEE Hours: 03

Prerequisite: Signal Conditioning and Process Measurement Techniques

Course Objectives

1. To understand the concept of measuring unknown resistance and inductance using bridges
2. To study the characteristics of photo transistor, photo diode and LDR
3. To understand the concept of measuring displacement, strain and energy
4. To develop matlab programs for waveform generation, convolution, DFT and FFT
5. To develop matlab programs for filter design and sampling theorem

List of Experiments

1.Inductance measurement using Anderson bridge

2.Calibration and testing of single phase energy meter.

3Measurement of strain using strain gauge

4.To study and draw the characteristics of photo transistor, photo diode and LDR

5.Measurement of unknown resistance using Wheatstone Bridge

6.Measurement of displacement using LVDT transistor

7.Waveform generation: Square wave, Triangular wave and Trapezoidal wave

8.Verification of convolution theorem: Circular convolution and linear convolution

9.Computation of DFT IDFT using direct and FFT methods

10.Verification of Sampling theorem

11.Design of Butterworth low pass and high pass filter

12.Design of Chebyshev low pass and high pass filter

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EIL53	**CO1**	Measure the unknown resistance and inductance
	CO2	Draw and explain the characteristics of phototransistor, photodiode and LDR
	CO3	Measure the distance, strain and energy
	CO4	Develop the program for waveform generation, convolution, DFT and FFT
	CO5	Develop the program for filters and sampling theorem

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3							2	1		2	3		
CO2	3	3							2	1		2	3		
CO3	3	3							2	1		2	3		
CO4	3	3	1						2	1		2	3	3	
CO5	3	3	1						2	1		2	3	3	