

Lesson Plan

Subject: Electronics

Semester: I

ELT-MD-CC-1-1-TH

**Course Name: Fundamentals of Circuit Theory
and Electronic Devices [Credits: 3; Lecture**

Hours: 45]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Fundamentals of Circuit Theory and Electronic Devices	Electric Circuit Elements	Resistance and Resistors: Types, Color Coding and Power Rating, Variable Resistors, Capacitance and Capacitors: Types, Color Coding and Voltage Rating	1 hour	Indrani Guha
		Electric Circuit Elements	Inductance and Inductors: Types, Color Coding, Inductor Coils,	1 hour	Indrani Guha
		Electric Circuit Elements	Air-core and Iron-core Coils, Self-inductance and Mutual-inductance, Transformers	1 hour	Indrani Guha
		Circuit Analysis	Concept of Voltage and Current Sources, Conservations of Flux Leakage associated with Inductors and Charge associated with Capacitors	1 hour	Indrani Guha
		Circuit Analysis	Kirchhoff's Voltage Law, Kirchhoff's Current Law, Transformation of Voltage and Current Sources	1 hour	Indrani Guha
		Circuit Analysis	Mesh Analysis and Node Analysis, Star-Delta Networks and Conversion	1 hour	Indrani Guha
		DC Analysis	Transient Responses of Series RL and RC	1 hour	Indrani Guha

			Circuits under DC Excitation		
		AC Analysis	Responses of Circuit Parameters, Frequency Response of Series RL, RC and RLC Circuits under AC Excitation	1 hour	Indrani Guha
		AC Analysis	Quality (Q) Factor of Inductor and Capacitor, Series and Parallel Resonance Circuits, Q-Factor	1 hour	Indrani Guha
		Network Theorems	Superposition Theorem, Thevenin's Theorem, Norton's Theorem	1 hour	Indrani Guha
		Network Theorems	Reciprocity Theorem, and Maximum Power Transfer Theorem	1 hour	Indrani Guha
		Semiconductor Basics	Semiconductor Materials: Types and Properties, Concept of Energy Bands in Solids: Metal, Insulator and Semiconductor	1 hour	Indrani Guha
		Semiconductor Basics	Intrinsic and Extrinsic Semiconductors, P-Type and N-Type Semiconductors, Energy Band Diagram, Concept of: Effective Mass	1 hour	Indrani Guha
		Semiconductor Basics	Direct and Indirect Bandgap Semiconductors, Fermi Level, Density of States, Mechanism of Current Conduction in Semiconductors (Drift and Diffusion)	1 hour	Indrani Guha
		Semiconductor Basics	Drift Velocity, Mobility,	1 hour	Indrani Guha

			Resistivity, Conductivity, Hall Effect (No derivation).		
		Junction Diode and Its Applications	PN Junction: Wafer Level Structure, Energy Band Diagram, Depletion Layer, Diode Equation and I-V Characteristics, Ideal Diode	1 hour	Indrani Guha
		Junction Diode and Its Applications	Static and Dynamic Resistance, Reverse Saturation Current, Zener and Avalanche Breakdown, Zener Diode	1 hour	Indrani Guha
		Junction Diode and Its Applications	Zener Diode as Voltage Regulator, Rectifiers: Half Wave Rectifier, Full Wave Rectifiers (Center tapped and Bridge), Peak Inverse Voltage, Ripple Factor, Efficiency	1 hour	Indrani Guha
		Junction Diode and Its Applications	Line Regulation, Load Regulation, Transformer Utilization Factor, Shunt Capacitor Filter, Concept of Bleeder Resistor	1 hour	Indrani Guha

		Bipolar Junction Transistor	Wafer Level Structure, and Brief Manufacturing Techniques (Growth, Alloy or Fused, Diffusion, Epitaxy), Energy Band Diagram, Doping Profile	1 hour	Indrani Guha
		Bipolar Junction Transistor	PNP and NPN Transistors, Common Base (CB), Common Emitter (CE) and Common Collector (CC) Configurations		
		Bipolar Junction Transistor	Working Principle, Emitter (Injection) Efficiency, Base Transportation Factor, Current Components in BJT, Current Gains: α , β and γ		

		Bipolar Junction Transistor	Input and Output Characteristics in CB, CE and CC Modes, Early Effect and Voltage, Leakage Currents		
		Transistor Biasing	Need for Biasing and Bias Stabilization, Load Line and Q-Point, Stability and Stability Factor, Thermal Runaway		
		Transistor Biasing	Fixed Bias, Collector to Base Bias, Voltage Divider Bias and Emitter Bias		

		BJT Amplifiers	r_e -model and h -Parameter Equivalent Circuit of BJT, Small Signal Analysis of Single Stage CE Amplifier		
		BJT Amplifiers	Frequency Response, Input and Output Impedances, Current, Voltage and Power Gains, Concept of Class A, B, AB and C Amplifiers		
		Field Effect Transistor	Junction FET, Formation of Channel and Operating Principle, Pinch Off and Saturation Voltages and Currents		

		Field Effect Transistor	Small Signal Equivalent Circuits of JFET in Common Source (CS), Common Drain (CD) Configurations		
		Field Effect Transistor	Voltage Gain, Input and Output Impedances of CS FET Amplifier, Normally-Off and Normally-On MESFET		

Lesson Plan

Subject: Electronics

Semester: I

ELT-MD-CC-1-1-P

Course Name: Fundamentals of Circuit Theory and Electronic Devices

Laboratory[Credits: 1; Contact Hours: 30]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Fundamentals of Circuit Theory and Electronic Devices Laboratory		To Familiarize with Basic Electronic Components (R, C, L, Diodes, Transistors), Digital Multimeter, Function Generator and Oscilloscope	2 hour	Indrani Guha
			Verification of (a) Thevenin's Theorem and (b) Norton's Theorem.	2 hour	Indrani Guha
			Verification of (a) Superposition Theorem and (b) Maximum Power Transfer Theorem	2 hour	Indrani Guha
			Study of the I-V Characteristics of (a) P-N Junction Diode and (b) Zener Diode.	2 hour	Indrani Guha
			Study of (a) Half Wave Rectifier and (b) Full Wave Rectifier (FWR) without and with Capacitor Filter	2 hour	Indrani Guha
			Study of Zener Diode as Voltage Regulator and its Load Regulation	2 hour	Indrani Guha

			Study of the I-V Characteristics of the Common Emitter Configuration of BJT	2 hour	Indrani Guha
			Study of the I-V Characteristics of the Common Base Configuration of BJT	2 hour	Indrani Guha
			Study of the I-V Characteristics of JFET	2 hour	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: II

ELT-MD-CC-2-2-TH

Course Name: Operational Amplifier and

Digital Systems[Credits: 3; Lecture Hours: 45]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Operational Amplifier and Digital Systems	Operational Amplifiers	Characteristics of Ideal and Practical Op-Amp, Open and Closed Loop Configuration	1 hour	Indrani Guha
		Operational Amplifiers	Frequency Response, Concept of Offset Voltage and Current, Bias Current, CMRR, PSRR, Slew Rate	1 hour	Indrani Guha
		Applications of Op-Amps	Inverting and Non-Inverting Amplifiers, Concept of Virtual Ground, Summing and Difference Amplifiers	1 hour	Indrani Guha
		Applications of Op-Amps	Differentiator, Integrator, Multiplier and Divider, Logarithmic and Anti-logarithmic Amplifiers.	1 hour	Indrani Guha
		Applications of Op-Amps	Voltage to Current and Current to Voltage Converters, Comparator and Zero-Crossing Detector, Schmitt Trigger	1 hour	Indrani Guha
		Number System and Codes	Weighted and Non-Weighted Codes, Decimal, Binary, Octal and Hexadecimal Number Systems, Base Conversions, 1's and 2's Complements	1 hour	Indrani Guha

		Number System and Codes	Representation of Signed and Unsigned Numbers, Binary Codes (BCD, 8-4-2-1, Excess-3, Gray Codes), Alphanumeric Codes, ASCII, EBCDIC	1 hour	Indrani Guha
		Number System and Codes	Fixed and Floating Point Arithmetic, Binary and Hexadecimal Arithmetic, Addition, Subtraction by 2's Complement Method,	1 hour	Indrani Guha
		Number System and Codes	BCD Addition, Parity Bits, Error Detecting and Correcting Code (Hamming)	1 hour	Indrani Guha
		Boolean Algebra and Logic Gates	Positive and Negative Logic, Basic Postulates and Fundamental Theorems of Boolean Algebra, De Morgan's Theorems	1 hour	Indrani Guha
		Boolean Algebra and Logic Gates	Logic Symbol and Truth Tables of Basic Logic Gates (AND, OR, NOT)	1 hour	Indrani Guha
		Boolean Algebra and Logic Gates	Derived Logic Gates (NAND, NOR, XOR and XNOR), Universal Property of NOR and NAND gates	1 hour	Indrani Guha
		Digital Logic Families	Characteristics of Logic Families (TTL and CMOS), Fan-in, Fan-out, Noise Immunity, Noise Margin	1 hour	Indrani Guha
		Digital Logic Families	Power dissipation, Figure of Merit, Speed Power	1 hour	Indrani Guha

			Product, Propagation Delay, Comparison of TTL and CMOS Families		
		Combinational Logic Analysis	Standard Representation of Logic Functions (SOP and POS)	1 hour	Indrani Guha
		Combinational Logic Analysis	Karnaugh Map Minimization (up to 4 Variables)	1 hour	Indrani Guha
		Combinational Circuits Design	Half and Full Adder, Half and Full Subtractor, 4-Bit Binary Adder and Subtractor	1 hour	Indrani Guha
		Combinational Circuits Design	Multiplexers, Demultiplexers, Encoder, Decoder, Code Converters	1 hour	Indrani Guha
		D-A and A-D Conversion	4-Bit Binary Weighted and R-2R D-A Converter, Circuit and Working, Accuracy and Resolution	1 hour	Indrani Guha
		D-A and A-D Conversion	A-D Conversion Characteristics, Successive Approximation ADC. (Mention of relevant ICs for all)	1 hour	Indrani Guha
		Sequential Circuits	Latches, Flip Flops (SR, JK, D and T), Truth Table, Excitation Table and Excitation Equation, Clocked (Level and Edge Triggered) Flip Flops		
		Sequential Circuits	Preset and Clear Operations, Race Around Conditions in JK Flip Flop		
		Sequential Circuits	Master-Slave JK Flip Flop		
		Shift Registers	Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out		

		Shift Registers	Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out		
		Counters (4 bits)	Ripple, Ring, Johnson, Synchronous, Asynchronous		
		Counters (4 bits)	Decade and Modulo-N Counters (Asynchronous only).		

Lesson Plan

Subject: Electronics

Semester: II

ELT-MD-CC-2-2-P

Course Name: Operational Amplifier and Digital Systems

Laboratory[Credits: 1; Contact Hours: 30]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Operational Amplifier and Digital Systems		To Design Inverting and Non-Inverting Amplifiers using Op-Amp (741/351) for DC Voltage of given Gain	2 hour	Indrani Guha
			To Add two DC Voltages using Op-Amp in Inverting and Non-Inverting Mode .	2 hour	Indrani Guha
			To Design Differentiator and Integrator Circuit using Op-Amp (741/351).	2 hour	Indrani Guha
			To Design Comparator and Schmitt Trigger Circuit using OPAMP .	2 hour	Indrani Guha
			To Verify and Design AND, OR, NOT and XOR Gates using NAND Gates	2 hour	Indrani Guha
			To Convert Boolean Expression into Logic Circuit and Design it using Logic Gate ICs	2 hour	Indrani Guha

			To Design Half Adder and Full Adder	2 hour	Indrani Guha
			To Design Half Subtractor and Full Subtractor	2 hour	Indrani Guha
			To Design 4-Bit Binary Adder and Adder-Subtractor using Full Adder IC 7483	2 hour	Indrani Guha
			To Design 4×1 Multiplexer using Logic Gates	2 hour	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: III

Course Name: Communication Electronics

Course Code: ELT-G-CC-3-3-TH / ELT-A-GE-3-3-TH

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Electronic Communication	Electronic Communication	Introduction to Communication, Means and Modes, Need for Modulation, Block Diagram of an Electronic Communication System, Brief Idea of Frequency	1 hour	Indrani Guha
		Electronic Communication	Allocation for Radio Communication System in India (TRAI), Electromagnetic Communication Spectrum, Band Designations and Usage	1 hour	Indrani Guha
		Electronic Communication	Channels and Base-Band Signals, Noise, Internal and External Noises, Signal-to-Noise (S/N) Ratio and Noise Figure	1 hour	Indrani Guha
		Amplitude Modulation	Definition, Representation, Modulation Index, Expression for Instantaneous Voltage, Power Relations, Frequency Spectrum	1 hour	Indrani Guha
		Amplitude Modulation	Concept of DSBFC, DSBSC, SSBSC Generation and Detection, Limitations of AM).	1 hour	Indrani Guha

		Amplitude Modulation	Demodulation, AM Detection, Diode Detector Circuit, Principle of Working and Waveforms, Concept of VSB, Block Diagram of AM Transmitter and Receiver	1 hour	Indrani Guha
		Frequency Modulation and Phase Modulation	Definition, Representation, Modulation Index, Frequency Spectrum, Bandwidth Requirements, Frequency Deviation and Carrier swing	1 hour	Indrani Guha
		Frequency Modulation and Phase Modulation	Equivalence between FM and PM, Generation of FM using VCO, Demodulation, FM Detector, Slope Detector Circuit	1 hour	Indrani Guha
		Frequency Modulation and Phase Modulation	Principle of Working and Waveforms, Block Diagram of FM Transmitter and Receiver, Comparison of AM and FM, Qualitative Idea of Super Heterodyne Receiver	1 hour	Indrani Guha
		Analog Pulse Modulation	Channel Capacity, Sampling Theorem, Basic Principles of PAM, PWM and PPM	1 hour	Indrani Guha
		Analog Pulse Modulation	Modulation and Detection Technique for PAM only, Multiplexing, TDM and FDM	1 hour	Indrani Guha
		Digital Modulation Techniques	Need for Digital Transmission, Block Diagram of Digital	1 hour	Indrani Guha

			Transmission and Reception, Pulse Code Modulation, Sampling		
		Digital Modulation Techniques	Quantization (Uniform and Non-uniform), Quantization Error, Companding, Encoding, Decoding, Regeneration	1 hour	Indrani Guha
		Digital Modulation Techniques	Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)	1 hour	Indrani Guha
		Digital Modulation Techniques	Advantages and Disadvantages of Digital Communication, Characteristics of Data Transmission Circuits, Shannon Limit for Information Capacity, Bandwidth Requirements	1 hour	Indrani Guha
		Digital Modulation Techniques	Data Transmission Speed (Bit Rate and Baud Rate), Noise, Cross Talk, Echo Suppressors, Distortion and Equalizer	1 hour	Indrani Guha
		Cellular Communication	Absolute RF Channel Numbers (ARFCN), Frequency Reuse, Roaming and Hand Off, Authentication of SIM Card of Subscribers, IMEI Number	1 hour	Indrani Guha

		Cellular Communication	Need for Data Encryption, Architecture (Block Diagram) of Cellular Mobile Communication Network, Concept of GSM	1 hour	Indrani Guha
		Cellular Communication	CDMA, TDMA and FDMA, Comparison of TDMA and FDMA Technology	1 hour	Indrani Guha
		Cellular Communication	Simplified Block Diagram of Cellular Phone Handset, Comparative Study of GSM and CDMA, Qualitative concepts of 2G, 3G and 4G, Qualitative idea of GPS Navigation System	1 hour	Indrani Guha

		Satellite Communication	Introduction, Need, Geosynchronous Satellite Orbits, Geostationary Satellite, Advantages of Geostationary Satellites		
		Satellite Communication	Satellite Visibility, Transponders (C-Band), Friis Transmission Equation, Path Loss, Ground Station		
		Satellite Communication	Simplified Block Diagram of Earth Station, Uplink and Downlink		

Lesson Plan

Subject: Electronics

Semester: III

Core Course (CC) - 1C Practical / Generic

Elective - 3 Practical Course Code: ELT-G-

CC-3-3-P / ELT-A-GE-3-3-P

Course Name: Communication

Electronics Lab[Credits: 02; Lecture

Hours: 56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Electronic Communication		To Design an Amplitude Modulator using Transistor.	2 hour	Indrani Guha
			To Study Envelope Detector for Demodulation of AM Signal	2 hour	Indrani Guha
			To Study FM Generator and Detector Circuit	2 hour	Indrani Guha
			To Study Pulse Amplitude Modulation (PAM)	2 hour	Indrani Guha
			To Study Pulse Width Modulation (PWM).	2 hour	Indrani Guha
			To Study Pulse Position Modulation (PPM).	2 hour	Indrani Guha
			To Study ASK, PSK and FSK Modulators.	2 hour	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: IV

Core Course (CC) - 1D Practical / Generic

Elective - 4 Practical Course Code: ELT-G-CC-4-4-P / ELT-A-GE-1-1-P

Course Name: Microprocessors and

Microcontrollers Lab [Credits: 02; Lecture Hours:

56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Section-A: Programs using 8085 Microprocessor		Transfer of Block of Data	2 hours	Indrani Guha
			Addition and Subtraction of Numbers using Direct Addressing Mode.	2 hours	Indrani Guha
			Addition and Subtraction of Numbers using Indirect Addressing Mode	2 hours	Indrani Guha
			1. Multiplication by Repeated Addition 2. Division by Repeated Subtraction	2 hours	Indrani Guha
			1. Handling of 16-Bit Numbers. 2. Search a given Number in a given List.	2 hours	Indrani Guha
			1. Generate Fibonacci Series. 2. Sorting of numbers in Ascending/Descending Order	2 hours	Indrani Guha
			1. To Find Square Root of an Integer. 2. Use of CALL and RETURN Instruction.	2 hours	Indrani Guha

			<p>1.To Study Interfacing of IC 8255.</p> <p>2.Other Programs (e.g. Parity Check, using Interrupts, etc.).</p>	2 hours	Indrani Guha
			<p>1.Program to Verify Truth Table of Logic Gates.</p>	2 hours	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: IV

Core Course (CC) - 1D Practical / Generic

Elective - 4 Practical Course Code: ELT-G-CC-4-4-P / ELT-A-GE-1-1-P

Course Name: Microprocessors and

Microcontrollers Lab [Credits: 02; Lecture Hours:

56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Section-B: Experiments using 8051 Microcontroller:		1.To Find that the given Numbers are Prime or not. 2.To Find the Factorial of a Number.	2 hours	Indrani Guha
			To Find (a) Largest of N Numbers and (b) Smallest of N numbers	2 hours	Indrani Guha
			1.To Find Whether the given Data is Palindrome. 2.To Arrange the Numbers in Ascending/Descending Order	2 hours	Indrani Guha
			Write a Program to Make the Two Numbers Equal by Increasing the Smallest Number and Decreasing the Largest Number.	2 hours	Indrani Guha
			Use one of the Four Ports of 8051 for O/P Interfaced to Eight LED's. Simulate Binary Counter (8 Bit) on LED's.	2 hours	Indrani Guha
			1.Program to Glow the First Four LEDs then next	2 hours	Indrani Guha

			Four using TIMER Application. 2.Program to Rotate the Contents of the Accumulator First Right and then Left.		
			1.Program to Rotate the Contents of the Accumulator First Right and then Left. 2.Program to Run a Countdown from 9-0 in the Seven Segment LED Display.	2 hours	Indrani Guha
			To Interface Seven Segment LED Display with 8051 Microcontroller and Display 'HELP' in the SevenSegment LED Display.	2 hours	Indrani Guha
			To Toggle '1234' as '1324' in the Seven Segment LED Display.	2 hours	Indrani Guha
			Interface Stepper Motor with 8051 and Write a Program to Move the Motor through a given Angle in Clockwise or Counter Clockwise Direction.	2 hours	Indrani Guha

			Application of Embedded Systems: Temperature Measurement and Display on LCD	2 hours	Indrani Guha
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Lesson Plan

Subject: Electronics

Semester: V

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
V	Semiconductor Devices fabrication	Introduction	Energy bands in materials, Semiconductor and Insulator, Doping in Semiconductors	1 hour	Indrani Guha
		Introduction	Defects, Point, Line, Schottky and Frenkel, Single Crystal, Polycrystalline and Amorphous Materials, Czochralski Technique for Silicon Single Crystal Growth	1 hour	Indrani Guha
		Thin Film Growth Techniques and Processes	Vacuum Pumps, Primary Pump (Mechanical) and Secondary Pumps (Diffusion, Turbo Molecular, Cryopump, Sputter Ion),	1 hour	Indrani Guha
			Vacuum Gauges (Pirani and Vacuum Pumps, Primary Pump (Mechanical) and Secondary Pumps (Diffusion, Turbo Molecular, Cryopump, Sputter Ion), Penning), Sputtering,	1 hour	Indrani Guha
			Evaporation (Thermal, Electron Beam), Pulse Laser Deposition (PLD), Chemical Vapor Deposition (CVD), Epitaxial Growth, Deposition by Molecular Beam Epitaxy (MBE).	1 hour	Indrani Guha
		Thermal Oxidation Process	Dry and Wet, Passivation, Metallization	1 hour	Indrani Guha
			Diffusion of Dopants, Diffusion Profiles, Ion Implantation.	1 hour	Indrani Guha

		Semiconductor Devices	Review of P-N Junction Diode, Metal-Semiconductor Junction, Metal-Oxide-Semiconductor (MOS) Capacitor and Its C-V Characteristics	1 hour	Indrani Guha
			MOSFET (Enhancement and Depletion Mode) and its High Frequency Limit, Microwave Devices, Tunnel Diode.	1 hour	Indrani Guha
		Memory Devices	Volatile Memory, Static and Dynamic Random Access Memory (RAM), Complementary Metal Oxide Semiconductor (CMOS) and NMOS	1 hour	Indrani Guha
			Non-Volatile, NMOS (MOST, FAMOS), Ferroelectric Memories	1 hour	Indrani Guha
			Optical Memories, Magnetic Memories, Charge Coupled Devices (CCD)	1 hour	Indrani Guha
		VLSI Processing	Introduction of Semiconductor Process Technology, Clean Room Classification, Line Width, Photolithography, Resolution and Process, Positive and Negative Shadow Masks	1 hour	Indrani Guha
			Photoresist, Step Coverage, Developer, Electron Beam Lithography, Idea of Nano-Imprint Lithography	1 hour	Indrani Guha
			Etching, Wet Etching, Dry Etching (RIE and DRIE), Basic Fabrication Process of R, C, P-N Junction	1 hour	Indrani Guha

			Diode, BJT, JFET, MESFET		
			MOS, NMOS, PMOS and CMOS Technology, Wafer Bonding, Wafer Cutting, Wire Bonding and Packaging Issues (Qualitative idea).	1 hour	Indrani Guha
		Micro Electro-Mechanical System (MEMS)); Introduction to MEMS, Materials Selection for MEMS Devices, Selection of Etchants	1 hour	Indrani Guha
			, Surface and Bulk Micromachining, Sacrificial Subtractive Processes, Additive Processes, Cantilever, Membranes	1 hour	Indrani Guha
			General Idea MEMS Based Pressure, Force, and Capacitance Transducers.	1 hour	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: VI

Discipline Specific Elective (DSE) - 1B

DSE-1B: Group-B Option-1 (DSE-1B-1) Theory ELT-G-DSE-6-B-1-TH: Electronic Instrumentation

[Credits: 04; Lecture Hours: 56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
VI	Electronic Instrumentation	Measurements	Accuracy and Precision, Significant Figures, Error and Uncertainty Analysis	1 hour	Indrani Guha
		Measurements	Sensitivity and Loading Effect, Shielding and Grounding, Electromagnetic Interference	1 hour	Indrani Guha
		Basic Measurement Instruments	PMMC Galvanometer, DC Measurement, Ammeter, Voltmeter, Ohmmeter, AC Measurement	1 hour	Indrani Guha
		Basic Measurement Instruments	Digital Voltmeter Systems (Integrating and Non-integrating), Digital Multimeter, Measurement of Low Resistance by Kelvin's Double Bridge Method	1 hour	Indrani Guha
		Basic Measurement Instruments	Medium Resistance by Voltmeter Ammeter Method and Wheatstone Bridge Method and High Resistance by Megger AC Bridges	1 hour	Indrani Guha
		Basic Measurement Instruments	Measurement of Self Inductance by Maxwell's Bridge, Hay's Bridge and Anderson's Bridge	1 hour	Indrani Guha
		Basic Measurement Instruments	Measurement of Capacitance by Schering's Bridge	1 hour	Indrani Guha

			and De Sauty's Bridge, Measurement of Frequency by Wien's Bridge Method		
		Oscilloscope	Block Diagram, CRT, Waveform Display and Electrostatic Focusing, Time Base and Sweep Synchronisation, , Screens for CRT, Oscilloscope Probes	1 hour	Indrani Guha
		Oscilloscope	Measurement of Voltage, Frequency and Phase by CRO, Digital Storage Oscilloscopes- Principle and Working, Advantages and Applications	1 hour	Indrani Guha
		Oscilloscope	CRO Specifications (Bandwidth, Sensitivity, Rise-Time), LCD Display for Instruments	1 hour	Indrani Guha
		Signal Generators	Audio Oscillator, Pulse Generator	1 hour	Indrani Guha
		Signal Generators	Function Generators. (Qualitative only)	1 hour	Indrani Guha
		Transducers	Classification, Basic Requirements and Characteristics, Active and Passive Transducers, Resistive (Potentiometer and Strain Gauge, Theory, Temperature Compensation and Applications)	1 hour	Indrani Guha
		Transducers	Capacitive (Variable Area and Variable Air Gap Types), Inductive (LVDT)	1 hour	Indrani Guha

		Transducers	Piezoelectric Transducers, Measurement of Temperature (RTD, Semiconductor IC Sensors)	1 hour	Indrani Guha
		Transducers	Light Transducers (Photo Resistors and Photovoltaic Cells).	1 hour	Indrani Guha
		Data Acquisition using Arduino	Arduino, Birth, Open Source Community, Functional Block Diagram, Functions of each Pin, Arduino Development Boards- IDE	1 hour	Indrani Guha
		Data Acquisition using Arduino	I/O Functions, Looping Techniques, Decision Making Techniques, Designing of 1st Sketch, Programming of Arduino (Arduino ISP)	1 hour	Indrani Guha

		Data Acquisition using Arduino	Serial Port Interfacing, Basic Interfacing and I/O Concept, Interfacing LED, Switch, 7seg LED.	1 hour	Indrani Guha
		Bio-Medical Instrumentation	Bio-Amplifiers, Bio-Potentials, Bio-Electricity, Necessity for Special Types of Amplifiers for Biological Signal Amplifications	1 hour	Indrani Guha
		Bio-Medical Instrumentation	Different Types of Bio-Op-Amps, Electrodes for ECG, EEG and EMG	1 hour	Indrani Guha

		Bio-Medical Instrumentation	Block Diagram of ECG and EEG Systems, Brief Analysis of Graphs.	1 hour	Indrani Guha
		Satellite Communication	Simplified Block Diagram of Earth Station, Uplink and Downlink		

Lesson Plan

Subject: Electronics

Semester: VI

Discipline Specific Elective (DSE) - 1B

DSE-1B: Group-B Option-1 (DSE-1B-1) Theory ELT-G-DSE-6-B-1-TH: Electronic Instrumentation

[Credits: 04; Lecture Hours: 56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
VI	Electronic Instrumentation	Measurements	Accuracy and Precision, Significant Figures, Error and Uncertainty Analysis	1 hour	Indrani Guha
		Measurements	Sensitivity and Loading Effect, Shielding and Grounding, Electromagnetic Interference	1 hour	Indrani Guha
		Basic Measurement Instruments	PMMC Galvanometer, DC Measurement, Ammeter, Voltmeter, Ohmmeter, AC Measurement	1 hour	Indrani Guha
		Basic Measurement Instruments	Digital Voltmeter Systems (Integrating and Non-integrating), Digital Multimeter, Measurement of Low Resistance by Kelvin's Double Bridge Method	1 hour	Indrani Guha
		Basic Measurement Instruments	Medium Resistance by Voltmeter Ammeter Method and Wheatstone Bridge Method and High Resistance by Megger AC Bridges	1 hour	Indrani Guha
		Basic Measurement Instruments	Measurement of Self Inductance by Maxwell's Bridge, Hay's Bridge and Anderson's Bridge	1 hour	Indrani Guha

		Basic Measurement Instruments	Measurement of Capacitance by Schering's Bridge and De Sauty's Bridge, Measurement of Frequency by Wien's Bridge Method	1 hour	Indrani Guha
		Oscilloscope	Block Diagram, CRT, Waveform Display and Electrostatic Focusing, Time Base and Sweep Synchronisation, , Screens for CRT, Oscilloscope Probes	1 hour	Indrani Guha
		Oscilloscope	Measurement of Voltage, Frequency and Phase by CRO, Digital Storage Oscilloscopes- Principle and Working, Advantages and Applications	1 hour	Indrani Guha
		Oscilloscope	CRO Specifications (Bandwidth, Sensitivity, Rise-Time), LCD Display for Instruments	1 hour	Indrani Guha
		Signal Generators	Audio Oscillator, Pulse Generator	1 hour	Indrani Guha
		Signal Generators	Function Generators. (Qualitative only)	1 hour	Indrani Guha
		Transducers	Classification, Basic Requirements and Characteristics, Active and Passive Transducers, Resistive (Potentiometer and Strain Gauge, Theory, Temperature Compensation and Applications)	1 hour	Indrani Guha

		Transducers	Capacitive (Variable Area and Variable Air Gap Types), Inductive (LVDT)	1 hour	Indrani Guha
		Transducers	Piezoelectric Transducers, Measurement of Temperature (RTD, Semiconductor IC Sensors)	1 hour	Indrani Guha
		Transducers	Light Transducers (Photo Resistors and Photovoltaic Cells).	1 hour	Indrani Guha
		Data Acquisition using Arduino	Arduino, Birth, Open Source Community, Functional Block Diagram, Functions of each Pin, Arduino Development Boards- IDE	1 hour	Indrani Guha

Lesson Plan

Subject: Electronics

Semester: VI

DSE-1B: Group-B Option-1 (DSE-1B-

1) Practical ELT-G-DSE-6-B-1-P:

Electronic Instrumentation Lab

[Credits: 02; Lecture Hours: 56]

Semester	Paper	Unit/Module	Topic	Hours	Faculty Name
III	Electronic Instrumentation Lab		1. Design of Multi Range Ammeter and Voltmeter using Galvanometer. Measurement of Resistance by Wheatstone Bridge and Measurement of Bridge Sensitivity.	2 hours	Indrani Guha
			Measurement of Temperature by Thermocouples. To Determine the Characteristics of LVDT	2 hours	Indrani Guha
			To Determine the Characteristics of Thermistors and RTD.	2 hours	Indrani Guha
			Measurement of Temperature by Thermocouples and Study of Transducers like AD590 (Two Terminal Temperature Sensor), PT-100, J-type, K-type.	2 hours	Indrani Guha
			Characterization of Bio-Potential Amplifier for ECG Signals. Study on ECG Simulator	2 hours	Indrani Guha
			Measurement of Heart Sound using Electronic Stethoscope. Study on ECG Heart Rate Monitor/Simulator	2 hours	Indrani Guha
			Study of Pulse Rate Monitor with Alarm System	2 hours	Indrani Guha
			Measurement of Respiration Rate using Thermistor/Other Electrodes. Test the Different Arduino Boards, Open-	2 hours	Indrani Guha

			Source and Arduino Shields.		
			Install Arduino IDE and its Development Tool. Develop a Program to Blink LED for 1second.	2 hours	Indrani Guha
			Develop a Program to Interface Input Switches and Output LEDs with Development Board (Arduino).	2 hours	Indrani Guha
			Interface 7 Segment Display with Development Board (Arduino).	2 hours	Indrani Guha
			Interface LM35 Temperature Sensor with Arduino and Monitor Temperature on Serial Monitor	2 hours	Indrani Guha

		Data Acquisition using Arduino	I/O Functions, Looping Techniques, Decision Making Techniques, Designing of 1st Sketch, Programming of Arduino (Arduino ISP)	1 hour	Indrani Guha
		Data Acquisition using Arduino	Serial Port Interfacing, Basic Interfacing and I/O Concept, Interfacing LED, Switch, 7seg LED.	1 hour	Indrani Guha

		Bio-Medical Instrumentation	Bio-Amplifiers, Bio-Potentials, Bio-Electricity, Necessity for Special Types of Amplifiers for Biological Signal Amplifications	1 hour	Indrani Guha
		Bio-Medical Instrumentation	Different Types of Bio-Op-Amps, Electrodes for ECG, EEG and EMG	1 hour	Indrani Guha
		Bio-Medical Instrumentation	Block Diagram of ECG and EEG Systems, Brief Analysis of Graphs.	1 hour	Indrani Guha

		Satellite Communication	Simplified Block Diagram of Earth Station, Uplink and Downlink		
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