1.1.3

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Employability Contents	**Green**	
Entrepreneurship Contents	**Light Blue**	
Skill Development Contents	**Pink**	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	**Yellow**	

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

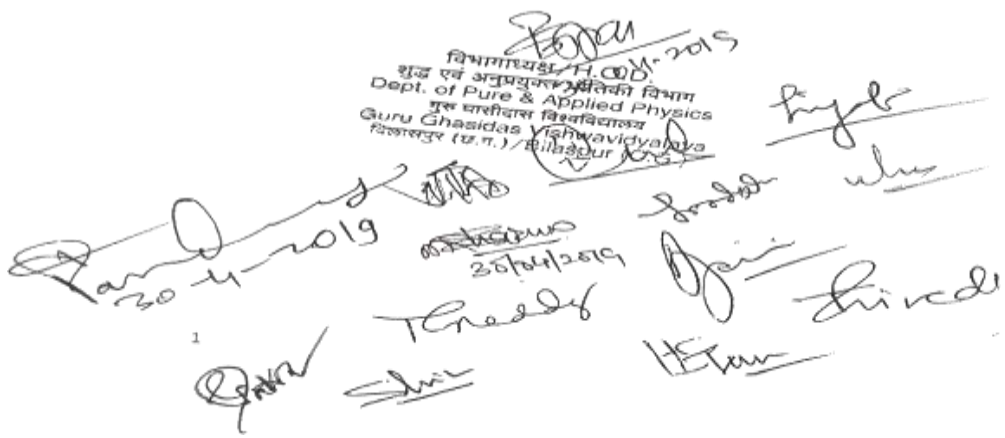
Department : *Pure and applied physics*

Programme Name : *B.Sc. (Hon.) Electronics*

Academic Year : 2018-19

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	PS/ELEC./C-101L	Basic Circuit Theory andNetwork Analysis
02.	PS/ELEC/C-203L	Semi-Conductor Devices
03.	PS/ELEC/C-204L	Applied Physics
04.	PS/ELEC/C- 301L	Electronic Circuits
05.	PS/ELEC/C- 302L	Digital Electronics andVHDL
06.	PS/ELEC/C- 303L	C Programming andData Structures
07.	PS/ELEC/C- 401L	Operational Amplifiersand Applications
08.	PS/ELEC/C- 402L	Signals and Systems
09.	PS/ELEC/C- 403L	Electronics Instrumentations
10.	PS/ELEC/C- 501L	Microprocessors andMicrocontrollers
11.	PS/ELEC/C- 502L	Electromagnetics
12.	PS/ELEC/C- 601L	CommunicationElectronics
13.	PS/ELEC/C- 602L	Photonics
14.		



Scheme and Syllabus

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Ordinance 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2021-22)

B.TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

SECOND YEAR, THIRD SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
	THEORY					Sessional			
			L	T	P	IA	ESE	TOTAL	
01.	CH203TBS05	Biology	3	0	0	30	70	100	3
02.	CH203TBS06	Mathematics-III	3	1	0	30	70	100	4
03.	CH203TPC01	Material and Energy Balance Calculations	3	1	0	30	70	100	4
04.	CH203TPC02	Fluid Mechanics	3	1	0	30	70	100	4
05.	CH203TPC03	Thermodynamics-I	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH203PPC01	Chemical Engineering Lab-I	0	0	3	30	20	50	1.5
02.	CH203PPC02	Fluid Mechanics Lab	0	0	3	30	20	50	1.5
		Total	15	3	6			600	21

IA – Internal Assessment
ESE - End Semester Examination
Total Credits: 21
Total Marks – 600
Total Periods / week - 24

BoS held on 01.10.2021
B. Tech. (Chemical Engg.)- II Year
w.e.f.: Session 2021-22

विभागाध्यक्ष/H.O.D.
शुद्ध एवं अनुप्रयुक्त भौतिकी विभाग
Dept. of Pure & Applied Physics
गुरु घासीदास विश्वविद्यालय
Guru Ghasidas Vishwavidyalaya
बिलासपुर (छ.ग.)/Bilaspur (C.G.)

Basic Circuit Theory and NetworkAnalysis

Semester –I(Credit Theory-04, Practical -02)

Objective- This course is designed to develop basic understanding of passive electronic components and their response under Dc and AC signal using network theorems.

Unit- 1 BasicCircuitConcepts:VoltageandCurrentSources,Resistors:FixedandVariableresistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel.

Inductors:FixedandVariable inductors,Selfand mutualinductance,Faraday'slawandLenz'slawofelectromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, Testing of resistance and inductance using multimeter.

Capacitors:Principlesofcapacitance,Parallelplatecapacitor,Permittivity,DefinitionofDielectricConstant,Dielectrics trength,Energystoredinacapacitor, Air,Paper,Mica,Teflon,Ceramic,Plasticand Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing ofcapacitors usingmultimeter.

Unit- 2 CircuitAnalysis:Kirchhoff'sCurrentLaw(KCL),Kirchhoff'sVoltageLaw(KVL),NodeAnalysis,M eshAnalysis, Star-Delta Conversion.

DCTransientAnalysis:RCCircuit- Charginganddischargingwithinitialcharge,RLCircuitwithInitialCurrent, Time Constant, RL andRC Circuits WithSources, DC Response ofSeries RLC Circuits.

Unit-3

AC Circuit Analysis:Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak toPeak, Root MeanSquareandAverageValues.Voltage-Current relationship in Resistor, InductorandCapacitor,Phasor, ComplexImpedance,PowerinACCircuits:InstantaneousPower,AveragePower,Reactive Power,Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits.

ResonanceinSeriesandParallelRLCCircuits,FrequencyResponseofSeriesand ParallelRLCCircuits,Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop.

Unit-4

NetworkTheorems: Principal of Duality, SuperpositionTheorem, Thevenin'sTheorem, Norton'sTheorem, Reciprocity Theorem,Millman's Theorem,MaximumPowerTransferTheorem.ACcircuitanalysisusing Network theorems.

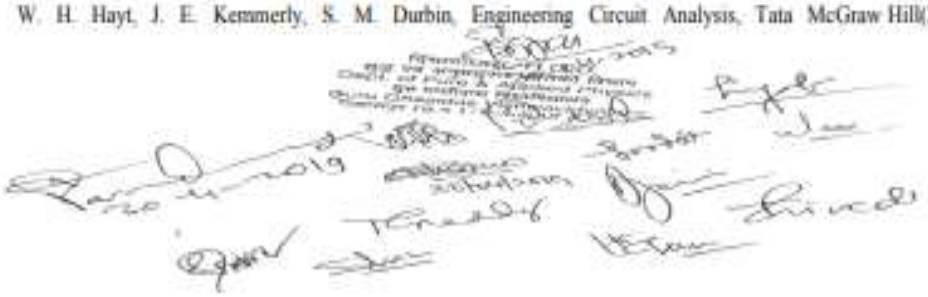
TwoPortNetworks:Impedance(Z)Parameters,Admittance(Y)Parameters, Transmission(ABCD)Parameters.

Outcomes - After completing the course, students should be able to:

Understand the passive electrical circuits elements such as resistances, capacitance and inductances, sources of electrical energy, analysis of linear electrical circuits under Dc and AC electrical signal (voltage and current)Simplifying the circuits using network theorems.

References:

1. S. A. Nasar, Electric Circuits, Schaum'soutline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi and J. Edminister,Schaum's Outline Series, Tata McGraw-Hill(2005)
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(200



SemiconductorDevices

Semester -II(Credits:Theory-04,Practicals-02)

Objective-

- Understand thefundamental concept, types, current voltage characteristics of semiconductor diodes of different biasing,MOSFET, Zener diodes
- Understand the fundamental principles and applications of modern electronic and optoelectronic semiconductor device

Unit 1 **Semiconductor Basics:** Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices,EnergyBandinSolids,ConceptofEffectiveMass,DensityofStates,CarrierConcentrationat NormalEqualibrium inIntrinsicSemiconductors,DerivationofFermiLevelforIntrinsic&Extrinsic Semiconductors,Donors,Acceptors, DependenceofFermiLevelonTemperatureandDopingConcentration,Temperature Dependence ofCarrierConcentrations. Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation And Recombination Processes, Continuity Equation.

Unit2V **P-N Junction Diode**:FormationofDepletionLayer,SpaceCharge ataJunction,DerivationofElectrostatic PotentialDifferenceatThermalEqulibrium,DepletionWidthandDepletionCapacitanceof anAbrupt Junction. Concept of Linearly Graded Junction, Derivation of Diode Equation and I-V Characteristics Zener and Avalanche Junction Breakdown Mechanism.
Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics,applications

Unit 3
Bipolar Junction Transistors (BJT): PNP and NPNTransistors, Basic Transistor Action, Emitter Efficiency,BaseTransportFactor,CurrentGain,EnergyBandDiagramof TransistorinThermalEqualibrium, QuantitativeAnalysisofStaticCharacteristics(MinorityCarrierDistributionandTerminalCurrents),Base- WidthModulation, Modes of operation, Input and Output Characteristicsof CB, CE and CC Configurations. Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.

Unit 4 **Field Effect Transistors:** JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-VoltageOutputCharacteristics. MOSFET, types of MOSFETs,Circuitsymbols,Workingand CharacteristiccurvesofDepletion typeMOSFET(bothNchannelandPChanneljandEnhancementtype MOSFET(both N channel and P channel). Complimentary MOS (CMOS).
PowerDevices: UJT, Basic constructionand working, Equivalentcircuit,intrinsicStandoffRatio, Characteristics and relaxation oscillator-expression. SCR, Construction,Working and Characteristics, Triac, Diac, IGBT, MESFET, Circuit symbols, Basic constructional features, Operation and Applications.
Outcomes - Understanding the connection between theory and practicalas well as to make familiar with Experiments.

References:
1.S. M. Sze, Semiconductor Devices: Physics and Technology,2nd Edition,Wiley India edition (2002).
2.Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)

AppliedPhysics -
(Credits:Theory-04,Practicals-02)

Objective - Develop the skills needed to set up the equipment required to test models ortheory developed in the lecture course

Unit-1

QuantumPhysics: InadequaciesofClassicalphysics, Compton'seffect,Photo-electricEffect,Wave-particle duality,deBroglie waves, Basicpostulatesandformalism ofquantum mechanics:probabilisticinterpretation ofwaves,conditionsforphysicalacceptabilityofwavefunctions.Schrodingerwaveequationforafree particleand inaforce-field(1dimension),Boundaryandcontinuityconditions.Operators inQuantum Mechanics,Conservationof probability, Time-dependentform,Linearity andsuperposition, Operators,Time- independent one dimensional Schrodinger wave equation, Stationary states, Eigen-values and Eigen functions.

Unit-2

Mechanical Properties of Materials: Elastic and Plastic Deformations, Hooke's Law, ElasticModuli, Brittle andDuctileMaterials,TensileStrength,TheoreticalandCriticalShearStressof Crystals.Strengthening Mechanisms, Hardness, Creep, Fatigue, Fracture.

Unit-3

ThermalProperties: Brief Introductionto Laws of Thermodynamics,ConceptofEntropy,Conceptof Phonons, Heat Capacity, Debye's Law, Lattice Specific Heat, Electronic Specific Heat, Specific Heat Capacity for Si and GaAs, Thermal Conductivity, Thermoelectricity,Seebeck Effect, Thomson Effect, Peltier Effect.

Unit-4

ElectricandMagneticProperties: Conductivityofmetals,Ohm'sLaw,relaxationtime,collisiontimeand meanfreepath,electronscatteringandresistivityofmetals,heatdevelopedincurrent carrying conductor, Superconductivity.

Classificationof MagneticMaterials,Origin of Magneticmoment,Originofdia, para,ferroandantiferromagnetism andtheircomparison,Ferrimagneticmaterials,SaturationMagnetisationandCurietemperature, Magnetic domains, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Outcomes- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.

References:

1. S. Vijaya and G. Rangarajan, Material Science, Tata McGraw Hill (2003)
2. W. E. Callister, Material Science andEngineering: An Introduction, Wiley India (2006)
3. A. Beiser, Concepts of Modern Physics, McGraw-Hill Book Company (1987)
4. A. Ghatak& S. Lokanathan, QuantumMechanics: Theory and Applications, Macmillan India (2004)
5. M.C. Jain , Quantum Mechanics

Electronics Circuits

Semester -III(Credits: Theory-04, Practicals-02)

Objective-

- To teach students how to analyzeelectrical filters and amplifiers using op- amps, transistors & diodes.
- To learn basic function of single stage amplifier, multistage amplifier and power Amplifier and their working principle.

Theory Lectures 60

Unit-1 (14 Lectures)

Diode Circuits: Ideal diode, dc load line analysis, Quiescent (Q) point. Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filters: types, circuit diagram and explanation of shunt capacitor filter withwaveforms.

Zener diode, regulator circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit-2 (15 Lectures)

Bipolar Junction Transistor: Review of CE, CB Characteristics and regions of operation. Hybrid parameters, Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor, Fixed bias without and with RE, collector to base bias, voltage divider bias and emitter bias ($+V_{CC}$ and $-V_{EE}$ bias), circuit diagrams and theirworking.

Transistor as a switch, circuit and working,BJT amplifier (CE), dc and ac load line analysis, hybrid model of CE configuration.

Unit-3 (13 Lectures)

Feedback Amplifiers: Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances . Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator.

Unit-4 (18 Lectures)

MOSFET Circuits: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.

Power Amplifiers: Classification of power amplifiers, Class A, Class B, Class C and their comparisons. Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, heatsinks.

Outcomes - To understand basic construction of feedback circuits and their application in Oscillators. To understand basic amplifier and oscillator circuits and their application

References:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013,PHI
2. Electronic devices, David A Bell, Reston PublishingCompany

Digital Electronics and Verilog/VHDL
(Credits: Theory-04, Practicals-02)

Objective –

- To learn Hardware Descriptive Language (Verilog/VHDL)
- To make the student learn and understand the basics of Logic Gates with CMOS such as NAND, NOR gates and flip flop.
- To understand the concept of Various Binary Number Systems and conversions

Theory Lectures 60

Unit-1 (11 Lectures)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code.

Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.

Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families.

Unit-2 (13 Lectures)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.

Unit-3 (18 Lectures)

Sequential logic design: Latches and Flip flops , S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations.

Programmable Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA

Unit-4 (18 Lectures)

Introduction to Verilog: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. Verilog Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design.

Data flow Modeling and Behavioral Modeling: Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays.

Outcomes –

- Demonstrate a clear Understanding in hardware design language Verilog HDL
- CO2 Model a Combinational circuit using hardware description language Verilog HDL and validate itsfunctionality

References:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia(1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall ofIndia(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill(1994)
5. A Verilog HDL Primer – J. Bhasker, BSP, 2003 IIEdition.
6. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

C Programming and Data Structures
(Credits: Theory-04, Practicals-02)

Ojective-

- To develop programming skills using the fundamentals and basics of C Language.
- To enable effective usage of arrays, structures, functions, pointers and to implement the memory management concepts.

Theory Lectures 60

Unit-1 (12 Lectures)

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program
Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators. Arrays-concepts, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays. Input output statement and library functions (math and string related functions).

Unit-2 (19Lectures)

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop. Functions: Defining functions, function arguments and passing, returning values from functions.
Structures: defining and declaring a structure variables, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions. Pointers.
Introduction to C++: Object oriented programming, characteristics of an object-oriented language.

Unit-3 (15 Lectures)

Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array implementation of queues.Linked List and its implementation.

Unit-4 (14 Lectures)

Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search.
Trees : Introduction to trees, Binary search tree, Insertion and searching in a BST.
Outcomes - Students will able to select appropriatedata structures as applied to specified problem definition.
References:

1. YashavantKanetkar, Let Us C , BPBPublications
2. Programming in ANSI C, Balagurusamy, 2nd edition,TMH.
3. Byron S Gottfried, Programming with C , SchaumSeries
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, PrenticeHall

Operational Amplifiers and Applications

Semester –IV(Credits: Theory-04, Practicals-02)

Objective -

- To study the characteristics and applications of operational amplifiers (op- amps).
- To study op-amp amplifiers, comparators, voltage and current regulators, summers, integrators, and differentiators as well as signal generator.
- To study multivibrators and active filters.

Theory Lectures 60

Unit-1 (18Lectures)

Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741)

Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Unit-2 (18Lectures)

Op-Amp Circuits: Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter.

Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.

Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator(IC 566).

Unit-3 (12Lectures)

Multivibrators (IC 555): Block diagram, Astable and monostablemultivibrator circuit, Applications of Monostable and Astablemultivibrators, IC565.

Fixed and variable IC regulators: IC 78xx and IC 79xx -concepts only, IC LM317- output voltage equation

Unit-4 (12Lectures)

Signal Conditioning circuits: Active filters: First order low pass and high pass Butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Log and antilog amplifiers.

Outcomes –

- Develop ability to define significance of Op Amps and their importance and build circuits using analog IC's.
- Develop in-depth knowledge of applying the concepts in real time applications such as adder, Subtractor, integrator, comparator
- Able to use OP Amp to generate sine waveform, Square wave form, Triangular wave forms.

References:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education(2003)
2. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education(2001)

Signals & Systems
(Credits: Theory-04, Practicals-02)

Objective –

- To introduce students the concept and theory of signals and systems needed in electronics and telecommunication engineering fields.
- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domain.

Theory Lectures 60

Unit-1 (17Lectures)

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

Unit-2 (13Lectures)

Linear Time -Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Invariability, Causality, Stability, Unit Step response.Differential and Difference equation formulation, Block diagram representation of first order systems.

Unit-3 (18Lectures)

Fourier Series Representation of Periodic Signals: Continuous-Time periodic signals, Convergence of the Fourier series, Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of Discrete-Time Fourier series.

Fourier Transform: Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform, Convolution and Multiplication Properties, Properties of Fourier transform and basic Fourier transform Pairs.**Unit-4** (12Lectures)

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Laplace Transform for signals, Laplace Transform Methods in Circuit Analysis, Impulse and Step response of RL, RC and RLC circuits.

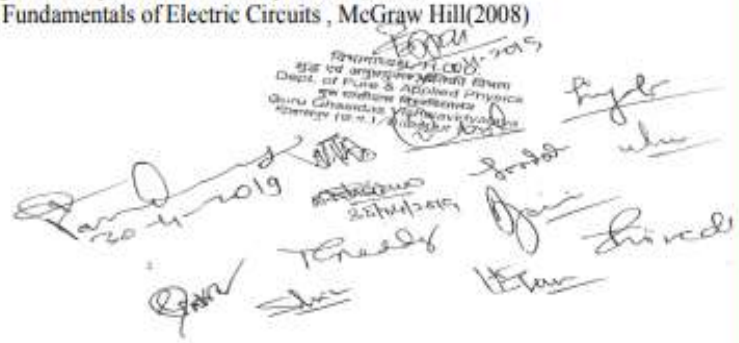
Outcomes –

After successful completion of the course student will be able to

- Understand about various types of signals and systems, classify them, analyze them, and perform various operations on them,
- Understand use of transforms in analysis of signals and system in continuous and discrete time domain.
- Observe the effect of various properties and operations of signals and systems.

References:

1. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education(2007)
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons(2004)
3. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill(2008)



Electronic Instrumentation
(Credits: Theory-04, Practicals-02)

Objective –

- To provide basic knowledge about the various sensors and data acquisition systems applied in Wireless sensor network.
- To provide fundamental concepts of control system such as mathematical modelling, time response and frequency response.

Theory Lectures 60

Unit-1 (15Lectures)

Qualities of Measurement: Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of data and curve fitting.

Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating types), digital multimeters, digital frequency meter system (different modes and universal counter).

Connectors and Probes: low capacitance probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, USB etc.

Unit-2 (15Lectures)

Measurement of Resistance and Impedance: Low Resistance: Kelvin's double bridge method, Medium Resistance by Voltmeter Ammeter method, Wheatstone bridge method, High Resistance by Megger. A.C. bridges, Measurement of Self Inductance, Maxwell's bridge, Hay's bridge, and Anderson's bridge, Measurement of Capacitance, Schering's bridge, DeSauty's bridge, Measurement of frequency, Wien's bridge.

A-D and D-A Conversion: 4 bit binary weighted resistor type D-A conversion, circuit and working. Circuit of R-2R ladder.A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Unit-3 (16Lectures)

Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).

Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit-4 (14Lectures)

Transducers and sensors: Classification of transducers, Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable Permittivity type), Inductive (LVDT) and piezoelectric transducers.

Measurement of displacement, velocity and acceleration (translational and rotational).Measurement of pressure (manometers, diaphragm, bellows), Measurement of temperature (RTD, thermistor, thermocouple, semiconductor IC sensors), Light transducers (photoresistors, photovoltaic cells, photodiodes).

Outcomes –

After successful completion of the course student will be able to

- Students will be able to explain principle of operation for various sensors.
- Students will be able to describe functional blocks of data acquisition system.

References:

1. H. S. Kalsi, Electronic Instrumentaion,TMH(2006)
2. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice-Hall(2005).
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K,TMH
4. E.O.Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
5. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education(2005)