B. TECH. ELECTRONICS & INSTRUMENTATION ENGINEERING

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-301	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE3-302	Digital Electronics	3	1	0	40	60	100	4
BECE3-303	Electrical Measurements & Instruments	3	1	0	40	60	100	4
BECE3-304	Network Analysis & Synthesis	3	1	0	40	60	100	4
BECE3-305	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE3-306	Digital Electronics Lab.	0	0	2	60	40	100	1
BECE3-307	Electromagnetic Field Theory	3	1	0	40	60	100	4
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BECE3-308	Training -I	0	0	4	60	40	100	2
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

SEMESTER 4th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-409	Linear Control System	3	1	0	40	60	100	4
BECE3-410	Transducers & Sensors	3	1	0	40	60	100	4
BECE3-411	Electrical and Electronics Instrumentation	3	1	0	40	60	100	4
BECE3-412	Microprocessors & Peripheral Devices	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BECE3-456	Antenna &Wave Propagation							
BECE3-457	Data Structures and Algorithms							
BECE3-458	Electronic Instrumentation							
BECE3-459	Reliability Engineering							
BECE3-413	Linear Control System Lab.	0	0	2	60	40	100	1
BECE3-414	Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-415	Microprocessor Lab	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations

SEMESTER 5th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-516	Pneumatic and Hydraulic Instrumentation	3	1	0	40	60	100	4
BECE3-517	Linear Integrated circuits	3	1	0	40	60	100	4
BECE3-518	Microcontroller and Embedded System	3	1	0	40	60	100	4
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE3-560	Advanced Microprocessor							
BECE3-561	Neural Networks and Fuzzy Logic							
BECE3-562	Digital Control System							
BECE3-563	Micro-Electronics							
Open Elective-I		3	0	0	40	60	100	3
BECE3-519	Instrumentation Lab. - II	0	0	2	60	40	100	1
BECE3-520	Microcontroller Lab.	0	0	2	60	40	100	1
BECE3-521	Linear Integrated circuits Lab.	0	0	2	60	40	100	1
BHUM0-F93	Soft Skills–III	0	0	2	60	40	100	1
BECE3-522	Training-II	0	0	0	60	40	100	2
Total		**15**	**3**	**8**	**500**	**500**	**1000**	**24**

SEMESTER 6th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-623	Analytical Instrumentation	3	1	0	40	60	100	4
BECE3-624	Optoelectronics Instrumentation	3	1	0	40	60	100	4
BECE3-625	Signal and Systems	3	1	0	40	60	100	4
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
BECE3-664	Nano-Science and Nano-Technology							
BECE3-665	Internet of Things							
BECE3-666	Information Theory and Coding							
BECE3-667	Optical Fiber Communication							
Open Elective-II		3	0	0	40	60	100	3
BECE3-626	Analytical Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-627	Industrial Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Total		**15**	**3**	**6**	**380**	**420**	**800**	**21**

SEMESTER 7th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-728	Biomedical Instrumentation	3	1	0	40	60	100	4
BECE3-729	Process Control	3	1	0	40	60	100	4
Departmental Elective-IV (Select any one)		3	0	0	40	60	100	3
BECE3-768	VLSI Design							
BECE3-769	Power Plant Instrumentation							
BECE3-770	Basics of Social Science, Economics and Industrial Management							
BECE3-771	Digital Systems Design							
Open Elective-III		3	0	0	40	60	100	3
BECE3-730	Process Control Lab.	0	0	2	60	40	100	1
BECE3-731	Training-III	0	0	0	60	40	100	4
BECE3-732	Minor Project	0	0	0	60	40	100	4
Total		**12**	**2**	**2**	**340**	**360**	**700**	**23**

SEMESTER 8th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-833	Virtual Instrumentation	3	1	0	40	60	100	4
Departmental Elective-V (Select any one)		3	0	0	40	60	100	3
BECE3-872	Programmable Logic Controller							
BECE3-873	Remote Sensing and Thermal Imaging							
BECE3-874	Advance Photonics							
BECE3-875	Data Acquisition and Processing							
BECE3-834	Virtual Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-835	Major Project	0	0	0	60	40	100	6
Total	**Total 2 Theory & 2 Lab. Courses**	**6**	**1**	**2**	**200**	**200**	**400**	**14**

Total Credits: 25 + 25 + 25 + 23 + 24 + 21 + 23 + 14 = 180

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE3-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
This course is meant to provide fundamental knowledge to ECE students for understanding of the basic semi-conductor devices and their behaviour under various conditions.

Course Outcomes:
Student after undergoing this course student will be able to:
1. Understand the concepts of PN junction diode and their applications
2. Understand BJT characteristics and determine their behavior under low and high frequencies.
3. Understanding of FETs and their characteristics
4. To understand low and high frequency models

UNIT-I (12 Hrs.)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, qualitative and quantitative analysis of its behaviour, Diode resistance, Transition capacitance and Diffusion capacitance, clippers, clampers, rectifiers. Special purpose diodes - Zener diode, varactor diode, schottky diode.

UNIT-II (12 Hrs.)

Bipolar Junction Transistor: BJT – Transistor current components, BJT configurations – CE, CB, CC and their characteristics. Transistor Biasing –Operating point determination, fixed bias, emitter bias, voltage-divider bias. Bias stability – Stabilization against variation in Ico, V_{BE} and β, Bias compensation.

UNIT-III (12 Hrs.)

Field-Effect Transistor: The junction FET - construction, operation, characteristics, parameters, Biasing of JFET, Small signal analysis of JFET as an amplifier- common source and common drain amplifiers. Metal Oxide Semiconductor FET: MOSFET- construction, operation, characteristics, parameters, CMOS devices, CMOS inverter characteristics, metal semiconductor.

UNIT-IV (12 Hrs.)

Low & High Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, 'Electronic Devices and Circuits', Tata McGraw- Hill, New Delhi.
2. Boylestad Nashelsky, 'Electronic Devices and Circuit Theory', Pearson Education.
3. Floyd, L. Thomas, 'Electronic Devices', 6th Edn., Pearson Education, **2002.**
4. Sedra, S. Adel and Smith, Kenneth C., 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

DIGITAL ELECTRONICS

Subject Code: BECE3-302 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives

1. To provide knowledge about basics of Digital Electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Course Outcomes

1. An ability to understand all types of combinational & sequential digital circuits and their designing.
2. Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.
3. To understand various sequential circuits & various Digital Logic families
4. Understand Analog to Digital and Digital to Analog converters and finite state machines

UNIT I (12 Hrs.)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT II (12 Hrs.)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT III (12 Hrs.)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT IV (12 Hrs.)

A/D and D/A Converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs.

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill.
2. Malvino & Leach, 'Digital Principles and Applications', McGraw Hill.
3. Taub & Schilling, 'Digital Integrated Electronics', McGraw Hill.

ELECTRICAL MEASUREMENTS & INSTRUMENTS

Subject Code: BECE3-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
1. To aware the students about the basics of Measurements and Instrumentation systems.
2. To impart knowledge about different instruments for electrical parameters.
3. To provide them basic concepts of different types of sensors and transducers.

Course Outcomes:
1. After the completion of course, students will be having skills to design, analyze and instruments.
2. Gain the skill knowledge of bridges and CRO operations.

UNIT I (12 Hrs.)

Introduction to measuring techniques, Necessity of measurements, block diagram of measurement system, Types of instruments, classification of standards, Fundamental Unit and Derived units. Instrument Characteristics; accuracy and precision, indications of precision, repeatability, Threshold, Sensitivity and span. Different types of errors in measurement, relative errors, limiting errors. Gross error, systematic errors, random error, Observational error, statistical analysis of data, arithmetic mean, deviation, average and standard deviation, probable error.

UNIT II (12 Hrs.)

Principle of operation and Constructional Features; D'Arsonval Galvanometer, Moving Coil PMMC & Moving Iron instrument (Repulsion and Attraction type), Electrodynamic instruments, Electrostatic instruments and Thermoelectric Instruments. Range Extension of Voltmeter and Ammeter (Without Mathematical Derivations).

UNIT III (12 Hrs.)

DC potentiometers; Basic potentiometer circuit, Compton type & multiple range potentiometer, constructional details & precision type potentiometers & their applications, AC potentiometer. Measurement of Power using two Wattmeter and three Wattmeter methods, Q meter.

UNIT IV (12 Hrs.)

Measurement of Resistance; Low, Medium and High using; Kelvin Double Bridge, Ammeter-Voltmeter method, substitution method, Wheat Stone Bridge, Loss of Charge and Megger. Measurement of Inductance and Capacitance using; Maxwell Inductance, Hay's, Anderson and Schering Bridges. Measurement of frequency by Wein bridge method.

Recommended Books:
1. Cooper Halfrick, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990**.
2. A.K. Sawhney, 'Electronic Instrumentation & Measurement', 19th Edn., Dhanpat Rai & Sons., **2011**.
3. Jones & Chin., 'Electronic Instruments and Measurement', 2nd Edn., **2010**.
4. J. Toppin, 'Theory of Errors', 4th Edn., Wessely Publishing, **2009**.

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: ECE3-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
1. To aware the students about the basics of networks.
2. To provide them basic concepts of different types of network theorems & their applications.

3. To impart knowledge about different circuits, analyzing and synthesizing methods of circuits.

Course Outcomes:

1. After the completion of course, students will be having skills to design, analyze and synthesize the circuits.
2. Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.

UNIT-I (12 Hrs.)

Circuit Concepts: Circuit elements; Independent and dependent sources, source transformation theory, Mesh & Nodal Analysis: Loop currents and loop equations, node voltages and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum power Transfer, Tellegen's, Reciprocity.

UNIT-II (12 Hrs.)

Network Functions: Terminal pairs or ports, network functions for one-port and two-port networks, pole and zeros of network functions, restrictions on pole and zero locations for driving point functions and transfer functions, time domain behavior from pole-zero plots. Stability criteria of active networks.

UNIT-III (12 Hrs.)

Transient Response: Transient Response of RC, RLC, RL circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform. Network synthesis techniques for two terminal network, foster and cauer form of synthesis.

UNIT-IV (12 Hrs.)

Fundamental of filters, filter networks, equation of filter network, classification and characteristic impedance of low-pass, high-pass, band-pass & band-reject, constant K filters, m – derived. Network synthesis: Hurwitz Polynomial, positive real functions, synthesis of one port and two port networks, elementary idea of active networks and frequency response.

Recommended Books:

1. A. Sudhakar & S.P. Shyammohan, 'Network Analysis', 2nd Edn., TMH, **1994**.
2. Van Valkenburg, 'Introduction to Modern Network Synthesis', 1st Edn., PHI, **1960**.
3. Van Valkenburg, 'Network Analysis', 6th Edn., PHI, **1974**.
4. G.K. Mithal, 'Network Analysis', 5th Edn., Khanna Publication, **2008**.
5. D. Roy Choudhury, 'Networks and Systems', 2nd Edn., New Age Pub., **2009**.

ELECTRONIC DEVICES AND CIRCUITS LAB. - I

Subject Code: BECE3-305 **L T P C**
0 0 2 1

Course Objectives

1. To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
2. To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
3. Able to understand identification and selection of various electronic components.

Course Outcomes

1. An ability to understand all types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyze and interpret data

EXPERIMENTS

1. Study of Zener regulator as voltage regulator
2. Study of Half wave, full wave & Bridge rectifiers.

3. To plot the input and output characteristics of CE configuration.
4. To study the characteristics of a Class- A amplifier.
5. To study the characteristics of Class- B amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
9. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
10. To demonstrate use of a BJT in a CC amplifier circuit configuration and study its frequency response.
11. To demonstrate use of a power BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

DIGITAL ELECTRONICS LAB.

Subject Code: BECE3-306 **L T P C**
0 0 2 1

Course Objectives

1. To provide knowledge about basics of Digital Electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Course Outcomes

1. An ability to understand all types of combinational & sequential digital circuits and their designing.
2. Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.

EXPERIMENTS

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates;
2. Realization of OR, AND, NOT and XOR functions using universal gates.
3. Realization Half Adder / Full Adder using Logic gates.
4. Realization Half Subtractor / Full Subtractor using Logic gates
5. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
6. Design 4-Bit magnitude comparator using logic gates. Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.
8. Flip Flops: Truth-table verification of RS, JK, D, JK Master Slave Flip Flops.
9. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
10. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.

Note: At least 08 experiments are required to be performed.

ELECTROMAGNETIC FIELD THEORY

Subject Code: ECE3-307 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course objectives:

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept and all the important fundamental parameters of transmission lines and waveguides.

Course Outcome:

1. After the completion of the course, the students will be familiar with the concepts of electromagnetic field theory and fundamental equations fields.
2. An ability to understand the concepts of magnetic field and magnetic field intensity.
3. An ability to understand Maxwell's equations in differential and integral forms.
4. To understand transmission lines and smith chart.

UNIT-I (12 Hrs.)

Introduction: Fundamental of vector algebra, Scalar & vector fields, Introduction and transformation on different coordinate systems: (rectangular, cylindrical and spherical co-ordinate system). Introduction to line, surface and volume integrals, definition of gradient, divergent and curl of a vector and their physical significance.

UNIT-II (12 Hrs.)

Electrostatics: Principal of Coulomb's law, definition of electric field intensity from point charges, field due to continuous distribution of charges on an infinite and finite line, Electric Field due to an infinite uniformly charged sheet. Gauss law and its applications, Electric flux density, potential fields due to electric dipole, Laplace and Poison equations.

Magnetostatics: Definition and explanation on Magnetic Field intensity due to a finite and infinite wire carrying current. Magnetic field intensity on rectangular loop carrying current, Amperes Circuital law and its applications, Biot-savart law, the Lorentz force equation for a moving charge, Magnetic Vector Potential.

UNIT-III (12 Hrs.)

Time Varying EM Fields: Maxwell's equation in differential and integral vector form and their interpretations, continuity of currents, conduction and displacement current, boundary conditions, Helmholtz equations, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal incidence and surface impedance. Energy Flow and Poynting theorem, interpretation of E×H, Simple application, complex pointing vector.

UNIT-IV (12 Hrs.)

Transmission Lines: Transmission line model, parameters and properties of transmission line equations, reflections in transmission lines; voltage, current and impedance relations-open, short circuit and matched lines, Standing wave ratio; impedance matching, quarter and half wave lines, single stub and double stub matching; circle diagram –Smithchart.

Recommended Books

1. Matthew N.O. Sadiku, 'Elements of Engineering Electromagnetics', Oxford University Press.
2. William Hayt, 'Engineering Electromagnetics', Tata McGraw Hill.

3. N. NarayanaRao, 'Elements of Engineering Electromagnetics', Pearson Education.
4. R.F. Jorden, 'Electromagnetic Waves & Radio System', Prentice Hall India.
5. J.D. Kraus, 'Electromagnetics', McGraw Hill.
6. Bhag Singh Guru and Hüseyin R. Hiziroglu, 'Electromagnetic Field Theory Fundamentals', Cambridge University Press.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Course, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

LINEAR CONTROL SYSTEM

Subject Code: BECE3-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:

1. To obtained transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
2. To learn basic goals of control systems in terms of transient/steady state time response behaviour.
3. To update the knowledge about control components.

Course Outcomes:

1. After the completion of the course, the students could have skills about the basics to model the control systems.
2. An ability to analyze the stability of designed systems

UNIT I (12 Hrs.)

Introduction to control systems; open loop and closed Loop systems-, Electrical to Mechanical and Mechanical to Electrical analogy. Block diagram reduction, Signal flow diagram & Meson`s gain formula

Time response analysis: Analysis of Test signals; step. Impulse, & ramp. Analysis of Zero, first & second order systems. Steady state errors, design of second order systems. Stability of control system, Routh Hurwitz's stability criterion, static and dynamic errors coefficients, errors criteria.

UNIT II (12 Hrs.)

Introduction of Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant, closed loop pole pair, Root contour plots, effect of addition of zeros & poles on root loci

UNIT III (12 Hrs.)

Introduction of frequency response, bode plots, log magnitude versus phase plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

UNIT IV (12 Hrs.)

Concept of state, state space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations. controllability & observability.

Recommended Books

1. Kuo, 'Automatic Control System', Princeton Univ. Press. Edition, **2010.**
2. D'Azzo and Houpis, 'Feedback Control System', McGraw Hill Pub. International Edition, **2010.**
3. Oagata, 'Modern Control Engineering', Prentice Hall Pub. Reprint, **2009.**
4. Nagrath & Gopal, 'Control Systems Engineering', New Age International Pub., **2011.**

TRANSDUCERS & SENSORS

Subject Code: BECE3-410 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
The main aim of this course is to understand the role of sensors and transducers for different communication systems. In this different transducers for Temperature, pressure, Liquid level measurement will be discussed in detail.

Course Outcomes:
For different process control industries sensors and transducers play a vital role. For DCS, SCADA or PLC operation basic idea about measurement will be boosted in the students.

UNIT-I (12 Hrs.)

Introduction to transducers and their classifications.

Pressure transducers: Manometers, Elastic transducers, High Pressure transducers, Mcloed Gauge, Pirani-gauge, Ionization gauge, Knudsen Gauge, pressure smart transmitters.

Temperature Transducers: Resistive transducers (Platinum Resistance Thermometer), Thermistor, Thermoelectric sensors, Solid-state Sensors & Pyrometers.

UNIT-II (12 Hrs.)

Flow Transducers: Classification of flow meter, Volume flow Sensors (orifice, Nozzle, Venture, Pitot type) Turbine type, Rotometers, Anemometers, Ultrasonic, Mass flow meters, Positive displacement type flow-meter, Open channel flow measurement, E.M. Flow-meter.

Level Transducers: Thermal effect type, Electric methods (Resistive method, Conductance probe method, Inductive level gauging and capacitive method), Ultrasonic method.

UNIT-III (12 Hrs.)

Force Transducers: Load Cell, Hydraulic Load Cell Torque Transducers: Absorption type, transmission Type, Stress Type, Deflection type.

Acoustics sensors: ceramic microphones, capacitor microphones, electric microphones, magnetic microphone, Humidity sensors: Hair hygrometer, electrode hygrometer, moisture sensors.

UNIT-IV (12 Hrs.)

Introduction to sensors. **Nano & Bio Sensors**: Structure of Protein, role of protein in nanotechnology, using protein in nanodevices, antibodies in sensing, antibody in nano particle conjugates, enzymes in sensing, enzyme nanoparticle hybrid sensors, Motor proteins in sensing, transmembrane sensors, Nan sensors based on Nucleotides and DNA; Structure of DNA, DNA decoders and microarrays; DNA protein conjugate based sensors, Bioelectronic sensors, biomagnetic sensors.

Recommended Books

1. A.K. Sawhney, 'Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai & Sons.
2. Douglas M. Considine, 'Process/Industrial Instruments & Controls Handbook', 6th Edn., McGraw Hill.
3. H.S. Kalsi, 'Electronic Instrumentation', TMH.
4. J.B. Gupta, 'Electrical, Electronics Measurement & Instrumentation', S.K. Kataria & Sons.
5. Kouroush Kalantar – Zadeh, Benjamin Fry, 'Nanotechnology enabled Sensors', Springer Verlag, New York, **2007**, ISBN-13: 978038732473.
6. D.V.S. Murthy, 'Transducers and Instrumentation', PHI, **2004**.

ELECTRICAL & ELECTRONICS INSTRUMENTATION

Subject Code: BECE3-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
The subject aims to enrich the students about different analog and digital instruments of electrical and electronics domain. To understand various measurements with different instruments.

Course Outcomes:
Subject will provide skills about handling different instruments. They will be able to measurement various unknown signals.

UNIT I (12 Hrs.)

Oscilloscope: Basic principle & construction, CRT, sweep modes, applications in measurement of voltage, freq. (Lissajous pattern), Dual Trace Oscilloscope, sweep modes, active, passive probes, delay line, analog storage oscilloscope, principle of secondary emission, Digital Storage Oscilloscope, sampling rate, sampling oscilloscope, application of the CRO in instrumentation and measurement, sampling oscilloscope. Comparison between analog and digital oscilloscope,

UNIT II (12 Hrs.)

Wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, applications of wave analyzer, Distortion analyzer, spectrum analyzer. **Digital Voltmeter**: Types of DVM; Ramp, Integrating, Successive approximation and Atomization in DVM. **Digital Frequency Meter**: Basic circuit, Frequency Measurement Circuit, High Frequency Measurement.

UNIT III (12 Hrs.)

Recorders: Strip Chart Recorders, X-Y Recorders, Ultraviolet Recorders, Magnetic Tape Recorders. **Display Devices**: Digital display methods, Seven Segment LED display, Dot Matrix display and LCD Display.
Nuclear Instrumentation: Geiger Muller Tube, Ionization Chamber, Scintillation Counter.

UNIT IV (12 Hrs.)

Basic Concept of measurement system, Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

Recommended Books:

1. A.K. Sawhney, 'Electrical & Electronic Measurement and Instrumentation', 4th Edn., Dhanpat Rai & Sons, **2012**.
2. Douglas M. Considine, 'Process/Industrial Instruments & Controls Handbook', 4th Edn., McGraw Hill, **2009**.
3. H.S. Kalsi, 'Electronic Instrumentation', 3rd Edn., TMH, **2010**.
4. J.B. Gupta, 'Electrical, Electronics Measurement & Instrumentation', 3rd Edn., S.K. Kataria & Sons, **2011**.

MICROPROCESSORS & PERIPHERAL DEVICES

Subject Code: BECE3-412 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
This course aims to provide detailed description of 8-bit microcontrollers, its architecture, programming, and interfacing. This course also briefly introduce the Next focus is to get student familiarize with architecture and programming of microcontrollers. Besides that, embedded systems are introduced.

Course Outcomes:
1. The students will acquire teaching skills about embedded life
2. They will be able to control various hardware devices with software.
3. Students will learn interfacing skills for different devices

UNIT-I (12 Hrs.)

Introduction:
Introduction to microprocessor, Intel 8085 microprocessor architecture and its operations, various functions, Data flow to/from memory, from/to microprocessor unit, multiplexing and de-multiplexing of address data bus. Comparative study of 8-bit microprocessors: 8085, Motorola 6800, Zilog Z-80.

UNIT-II (12 Hrs.)

Programming with 8085
Addressing modes, Bus timings, T state, machine cycle, timing diagram, Detail study of 8085 instruction set. Memory mapping. Interrupt: necessity, types and structure, stack and subroutines, Programming techniques: looping, counting. Efficient programming in view of memory and speed.

UNIT-III (12 Hrs.)

Interfacing with 8085
Concept of programmable devices, architecture and programming of 8155/8156 (programmable I/O port timer), 8254/8253 (programmable interval timer), 8255 (programmable peripheral interface), its interfacing with 8085 microprocessors. 8279 (keyboard display controller), 8237 (direct memory access controller), 8251(universal synchronous, asynchronous receiver transmitter) with 8085 microprocessor

UNIT-IV (12 Hrs.)

8086 Microprocessor
Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

Recommended Books
1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications with the 8085', 5th Edn., Penram International Pub., **2009**.
2. D.V. Hall, 'Microprocessor and Interfacing Programming and Hardware', 3rd Edn., McGraw Hill Co, **2012**.
3. Intel Data Books.

ANTENNA & WAVE PROPAGATION

Subject Code: BECE3-456 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course Objectives

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Course Outcome

1. An ability and development of skill of students to design highly effective communication system.
2. After completion of the course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
3. Understand various types of antennas such as micro strip and Yagi-uda antennas.
4. To understand Ground wave propagation.

UNIT-I (12 Hrs.)

ANTENNA BASICS: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II (12 Hrs.)

ANTENNA ARRAYS: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III (12 Hrs.)

SPECIAL ANTENNAS: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, micro strip antennas, fractal antennas.

UNIT-IV (12 Hrs.)

GROUND WAVE PROPAGATION: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

IONOSPHERE PROPAGATION: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

SPACE WAVE PROPAGATION: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Book

1. J.D. Kraus, 'Antennas', McGraw Hill.
2. C.A. Balanis 'Antennas Theory and Design', Willey.
3. K.D. Prasad, 'Antenna & Wave Propagation', Satya Parkashan, New Delhi.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE3-457 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course Objectives

1. To use object oriented programming to implement data structures.
2. To introduce linear, non-linear data structures and their applications.

Course Outcomes

Upon completion of the course, students will be able to:

1. Explain the concepts of algorithms, trees and graphs.
2. Write simple applications of data structures.
3. Discuss the different methods of organizing large amount of data**.**

UNIT-I (12 Hrs.)

INTRODUCTION: Data types, data structures, abstract data types, the running time of a program, the running time and storage cost of algorithms, complexity, asymptotic complexity, big O notation, obtaining the complexity of an algorithm.

DEVELOPMENT OF ALGORITHMS: Notations and Analysis, Storage structures for arrays - sparse matrices - structures and arrays of structures, Stacks and Queues: Representations, implementations and applications.

UNIT-II (12 Hrs.)

LINKED LISTS: Singly linked lists, linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists, Operations on linked lists- Insertion, deletion and traversal, dynamic storage management – Garbage collection and compaction.

TREES: Basic terminology, General Trees, Binary Trees, Tree Traversing: in-order, pre-order and post-order traversal, building a binary search tree, Operations on Binary Trees - Expression Manipulations - Symbol Table construction, Height Balanced Trees (AVL), B-trees, B+ -trees.

UNIT-III (12 Hrs.)

GRAPHS: Basic definitions, representations of directed and undirected graphs, the single-source shortest path problem, the all-pair shortest path problem, traversals of directed and undirected graphs, directed acyclic graphs, strong components, minimum cost spanning tress, articulation points and bi-connected components, graph matching.

UNIT-IV (12 Hrs.)

SORTING AND SEARCHING TECHNIQUES: Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

Recommended Books

1. J.P. Tremblay and P.G. Sorenson, ‘An Introduction to Data Structures with Applications’, Tata McGraw Hill.
2. S. Sahni, ‘Data Structures, Algorithms ad Applications in C++’, WCB/McGraw Hill.
3. Aho, Ullman and Hopcroft, ‘Data Structures and Algorithms’.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, ‘Data Structures using C’, Pearson Education.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE3-458 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course Objectives

1. To provide knowledge about different types of measuring, waveform generation, and analysis electronics instruments.
2. Exposure to various methods of data transmission and transduction.
3. Elaborate discussion about recorder & display devices.

Course Outcomes

1. Able to understand operation of different instruments and able to describe different terminology related to measurements.
2. A recognition and understanding of various analog measuring instruments.
3. Measurement of Resistance and understanding of CRO.

UNIT–I (12 Hrs.)

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales

UNIT –II (12 Hrs.)

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly Phase Circuits.

Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/applications.

UNIT – III (12 Hrs.)

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

UNIT-IV (12 Hrs.)

Cathodes Ray Oscilloscopes: Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books

1. A.K. Sawhney, 'Electrical & electronic Measurement and Instrumentation', Dhanpat Rai & Sons.
2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.

RELIABILITY ENGINEERING

Subject Code: BECE3-459 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course Objectives

1. To provide students with a comprehensive understanding on various aspects of reliability engineering
2. To enable students to understand reliability considerations in designing machine components, elements and systems
3. To ensure sound maintenance of machines and systems and bring about reliability improvement
4. To perform reliability engineering analysis and its management throughout the product life cycle.

Course Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems
3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

UNIT-I (12 Hrs.)

Introduction: Definition for Reliability, Static and Dynamic Reliability Need for reliability Engineering, success and failure models, Causes of failures, catastrophic failures and degradation failures Characteristic types of failures, useful life of components, Exponential case of chance failure, Reliability Measures; MTBF, MTTR, hazard rate, probability distribution function, Derivation for exponential distribution function, other kinds of distributions, Binomial, Poisson uniform, Raleigh, Weibull, Gamma distribution, marks, Chains, failures data analysis.

UNIT-II (12 Hrs.)

Series Parallel Systems: Reliability Block Diagrams, series systems, parallel systems, K-out of-M systems, open and short circuits failures, standby systems.

Reliability Analysis of Non-Series Parallel System: Boolean algebra Method, Outset approach, delta star method, logical signal relation method, Bay's Theorem Method.

Reliability Prediction: objective of reliability prediction, classification, and information sources for failure rate data, prediction methodologies, general requirements, Role and limitations of Reliability prediction.

UNIT-III (12 Hrs.)

Reliability Allocation: subsystems reliability improvement, allocation for new units, criticality.

Maintainability and Availability: forms of maintenance, measures of Maintainability and availability, maintainability function, availability function, two-unit parallel system with repair, Markov Model for two unit systems, preventive maintenance, provisioning of spares.

UNIT-IV (12 Hrs.)

Reliability Testing: kinds of testing, component reliability measurements, parametric methods, confidence limits, accelerated testing, equipment acceptance testing, standard life testing plans, accelerated life testing, system safety analysis-FMECA, risk priority number and its allocation.

Economics of Reliability Engineering: Reliability cost, Life Cycle Costing, effect of reliability on cost, reliability achievement cost models, reliability Utility cost models, Replacement policies.

Recommended Books

1. K.K. Agarwal, 'Reliability Engineering', Kluwer Academic Press, USA, **1993.**

2. E. Balagurusamy, 'Reliability Engineering', Tata McGraw Hill, 4th Reprint, **2003.**
3. L.S. Srinath, 'Reliability Engineering', East West Press Pvt. Ltd, 3rd Edn., **1991.**
4. Brijendra Singh, 'Quality Control and Reliability Analysis', Khanna Publishers, **1998.**
5. E.E. Lewis, 'Introduction to Reliability Engineering', John Wiley and Sons, **1987.**

CONTROL SYSTEM LAB.

Subject Code: BECE3-413 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the basics of MATLAB software.
2. To introduce variety of control system strategies.
3. To comment about the stability of designed systems.

Course Outcomes:

1. To acquire skills to understand all types of control components
2. An ability to analyze the stability of control systems

EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox
2. Determination of step response for first order & second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. To locate ploe zero locations of a control system.
4. Determination of Root Locus of a control system
5. Determination of Bode plot of a control system.
6. Determination of Nyquist Plot of a control system
7. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator & by compensator in forward path transfer function for unity feedback control system.
8. Determination of control system specifications for variations of system parameters in practical position control system.
9. Design of a second order linear time invariant control system and study of system response with unit step input.
10. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
11. To study the synchro Transmitter-Receiver set and to use it as an error detector
12. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
13. To study the Speed – Torque characteristics of a DC Servo Motor and explore its applications.
14. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
15. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
16. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer.

INSTRUMENTATION LAB.

Subject Code: BECE3-414 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measuring various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

Course Outcomes:

1. After the completion of the course, the students could have skills about the basic measurement circuits, their operational characteristics and their applications.
2. An ability to use the techniques and skills to CRO.

EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure high value of DC current and voltage using shunt and Multiplier.
3. To measurement of low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter method.
5. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.
6. To study and calibrate Energy Meter.
7. Measurement of resistance using Kelvin's Bridge.
8. Measurement of self-inductance using Anderson's Bridge.
9. Measurement of capacitance using Schering Bridge.
10. Plotting of Hysteresis loop for a magnetic material using flux meter.
11. Measurement of frequency using Wein's Bridge.
12. To study the connections and use of Current and Potential transformers and to find out ratio error.
13. Determination of frequency and phase angle using CRO.
14. Measurement of unknown voltage using potentiometer.

MICROPROCESSOR LAB.

Subject Code: BECE3-415 **L T P C**
0 0 2 1

1. Study of 8085 and 8086 Microprocessor Kits.
2. Write a program to add two 8-bit number using 8085.
3. Write a program to add two 16-bit number using 8085.
4. Write a program to subtract two 8-bit number using 8085.
5. Write a program to subtract two 16-bit number using 8085.
6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
7. Write a program to sort series using bubble sort algorithm using 8085.
8. Write a program to copy 12 bytes of data from source to destination using 8086.
9. Write a program to find maximum and minimum from series using 8086.
10. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.
11. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.
Course Outcomes
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE- Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.
IMPROVING PERCEPTION- Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING-Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING-Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT - Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

PNEUMATIC AND HYDRAULIC INSTRUMENTATION

Subject Code: BECE3-516 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives: The student should be able to,
1. Understand the pneumatic and hydraulic systems.
2. Be familiar with the hydraulic actuators and control valves.
3. To get the knowledge about timing and sequence diagrams.
4. Learn about the hydraulic and pneumatic controllers.

Course Outcomes:
At the end of the course, the student should be able to:
1. Identify the components required to build different types of pneumatic and hydraulic systems

2. Understand the concept of various control valves and hydraulic actuators
3. Identify solution for Pneumatic temperature, pressure transmitters & PLC.
4. Learn the working principle of Pneumatic Sensors and controllers.

UNIT I (12 Hrs.)

Introduction: Basic requirement for Pneumatic System, Servicing compressed air: Air compressors, air treatment stages, pressure regulation. Introduction to hydraulic system, comparison of pneumatic and hydraulic system.

UNIT II (12 Hrs.)

Pneumatic & hydraulic Actuators, cylinders Spring, spring less, spring with positioner piston & motor actuators, electro pneumatic actuators, cylinder lubrication, cylinder with sensors, hydraulic actuators, control valves, types of control valves, basic pneumatic circuits.

UNIT III (12 Hrs.)

Timing & Sequence Diagram: Cylinder sequencing hydraulic & pneumatic Accessories pneumatic telemetry systems: Pneumatic temperature & pressure transmitters their working & applications, electrical control in pneumatic circuit. Introduction to PLC, architecture of PLC, Programming of PLC.

UNIT IV (12 Hrs.)

Pneumatic & Hydraulic Controllers (P, PI, PID), P & ID Diagrams, Converters: I/P, P/I, Pneumatic Relay, Pneumatic Sensors Flapper nozzle assembly. Maintenance and troubleshooting of pneumatic and hydraulic systems. Introduction to Mechatronics and its approach.

Recommended Books

1. C.D. Johnson, 'Process Control Instrumentation Technology', PHI.
2. Krishan Kant, 'Computer Based Industrial Control', PHI.
3. Andrew Parr, 'Pneumatic & Hydraulic', PHI.
4. D. Considine, 'Process Industrial Instruments & Control Handbook', McGraw Hill.
5. B.G. Liptak, 'Instrument Engineers Handbook', CRC Press.

LINEAR INTEGRATED CIRCUITS

Subject Code: BECE3-517 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. Students will be able to understand basic concepts of OP-AMPs characteristics and their specifications.
2. Op-AMP applications to signal conditioning for amplifiers, filters and oscillators.
3. Op-AMP applications for comparators and data conversions will be studied.

Course Outcomes:

1. Students will be able to learn about the operational amplifiers and its characteristics as well as various types of op-amps.
2. Students will acquire the ability to design and test practical circuits for amplifiers.
3. Students will be able to analyze the operation of active filters.

UNIT-I (12 Hrs.)

Introduction to Op–Amp: Operational Amplifier, Block diagram, analysis and its schematic symbol, interpretation of IC 741 datasheet and characteristics, practical op–amp, all important electrical parameters and their values, Op-amp applications in open loop configuration.

Concept of Feedback, Op–Amp with Negative Feedback: Introduction and Block diagram representation of feedback configurations, Voltage Series feedback amplifier, Voltage Shunt feedback and derivation of important electrical parameters

UNIT-II (12 Hrs.)

Introduction to Operational Amplifiers and Characteristics: Introduction, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, inverting and non-inverting amplifier configurations.

The Practical op-amp: Introduction, input offset voltage, offset current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, slew rate and its Effect, PSRR and gain –bandwidth product, frequency limitations and compensations, transient response, interpretation of TL082 datasheet.

UNIT-III (12 Hrs.)

Amplifiers and Oscillators Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, isolation amplifiers, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO.

Active Filters: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, notch filter; all pass filters, self-tuned filters.

UNIT-IV (12 Hrs.)

Advanced Applications: Applications as Frequency Divider, PLL, AGC, AVC using op-AMP and analog multipliers, Amplitude modulation using analog multiplier, Frequency Shift Keying, simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, ADC TL0820 & DAC-7821.

Recommended Books

1. Ramakant A. Gayakward, 'Op–Amps & Linear Integrated Circuits', Pearson Education.
2. William D. Stanley 'Operational Amplifiers with Linear Integrated Circuits', 4th Edn.
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill.
4. 'Op Amps & Linear Integrated Circuits by Coughlin', Prentice Hall.

MICROCONTROLLER AND EMBEDDED SYSTEM

Course Code: BECE3-518 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. The student should be made to:
2. Study the Architecture of 8051 microcontroller.
3. Learn the design aspects of I/O and Memory Interfacing circuits.
4. Study about communication and bus interfacing.

Course Outcomes:

1. At the end of the course, the student should be able to:
2. Design and implement 8051 microcontroller based systems.
3. Serial communication 0f 8051.

4. Interfacing with 8051

UNIT I (12 Hrs.)

Introduction: 8051 microcontroller, comparison of microcontroller and microprocessors, Embedded Systems, 8051 Microcontroller: Architecture and Pin Diagram, Program Counter and RAM Spaces, Data types and Directives, Flag Bits and PSW Register, Register Banks and Stack, interrupt,

UNIT II (12 Hrs.)

Programming: Basic assembly language programming concepts Addressing Modes, Arithmetic, Logical instructions and Programming, I/O Port Programming, BCD and ASCII application programs, Single-bit instruction programming, Timers and Counter Programming, Jump and loop Instructions, Introduction of 8051 Programming in C.

UNIT III (12 Hrs.)

Serial Communication of 8051: Basics of Communication, Overview of RS-232, UART, USB, 8051 connections to RS-232, serial communication programming, Programming of timer interrupts, Programming of External hardware interrupts, Interrupt priority.

UNIT IV (12 Hrs.)

Interfacing with 8051: LCD and Keyboard Interfacing, interfacing with external memory and 8051 data memory space, interfacing with 8255, Sensors Interfacing and Signal Conditioning, interfacing with Stepper Motor and Servo motors, DS12887 RTC Interfacing and its programming.

Recommended Books:

1. Mazidi Muhammad Ali, 'The 8051 Microcontroller and Embedded Systems', Pearson Publications.
2. Manish K. Patel, 'The 8051 Microcontroller Based Embedded Systems', McGraw Hill Publications.
3. Scot MacKenzie, Raphael C.W Phan, 'The 8051 Microcontroller', Pearson Publications.
4. Kenneth J. Ayala, 'The 8051 Microcontroller', Thomson Publishers.

ADVANCED MICROPROCESSOR

Course Code: BECE3-560 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives

1. The purpose of this course is to introduce students with the advanced technology in embedded systems.
2. The objective is to make students understand architecture and programming of embedded processors.
3. Students will be able to learn and apply assembly language programming
4. Students will able to interface various circuits with advanced processors.

Course Outcomes

1. Students will have ability to deal with 16 bit microprocessors
2. They will be familiar with latest microprocessor and assembly language programming
3. Students will have skills to interface any peripheral devices with different microprocessors.
4. Students will have an introduction about more advanced processors like core to duo, I-5 & I-7.

Unit I

Microprocessor 8086: Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

Unit II

8086 Assembly Language Programming: 8086 flags, JUMP operations, STRING operations, CALL & RET operations, STACK operations, Instruction set of an 8086, 8086 hardware configuration, addressing memory & ports, 8086 Interrupts and interrupt responses, Interrupt system based on 8259 A**.**

Unit III

Interfacing with 8086 Microprocessor: Concept of programmable devices, architecture and programming of programmable I/O port timer, programmable interval timer, programmable peripheral interface, its interfacing with 8086 microprocessor.

Unit IV

Introduction to Advanced Microprocessors: Architectures of 80186-286-386-486, Pentium Processors, Dual core processors, Core to duo, I-5 and I-7 Processors.

Recommended Books:

1. Douglas V. Hall, 'Microprocessor & Interfacing: Programming & Hardware', Tata McGraw Hill.
2. M.A. Mazidi, J.G. Mazidi, R.D. Mc Kinlay 'The 8051 Micro Controllers & Embedded Systems', Pearson Education.
3. Kenneth J, Ayala, '8051 Microcontroller: Architecture, Programming and Application', Delmar Course.
4. Brey, 'Intel Micropocessors, The 8056/8055, 80186/80188, 8028, /80386, 80486, Pentium & PentiumPro, Pentium II, III, IV: Architecture, Programming and Interfacing', PHI.
5. Myke Predko, 'Programming and Customizing the ARM7 Microcontroller', McGraw-Hill.
6. John Morton, 'The PIC Microcontroller: Your Personal Introductory Course', Newnes (an imprint of Butterworth-Heinemann Ltd.).

NEURAL NETWORKS AND FUZZY LOGIC

Subject Code: BECE3-561 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

The student should be made to:

1. Learn the various soft computing frame works
2. Be familiar with design of various neural networks
3. Learn about the concepts of Fuzzification and De-Fuzzification.
4. Describe various optimization techniques.

Course Outcomes:

Upon completion of the course, the student should be able to:

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic and Fuzzy rules.
4. Learn and understand various optimization techniques.

UNIT I

Neural Networks: History, Overview of Biological Neuro-System, Terminology of Artificial Neural Network, Comparison of BNN and ANN, Mathematical Models of Neuron, ANN Architecture, Topology, Fundamental Course Laws, Course Paradigms-Supervised, Unsupervised and reinforcement Course.

UNIT II

Perceptron Architecture, Single layer perceptron, Perceptron Course Rules, Multi-layer perceptron, Back Propagation Algorithm, Associative Memories, Hopfield Networks, Competitive Course, Self-organizing Maps, ART Networks, Applications of Artificial Neural Networks.

UNIT III

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Linguistic Variables, Membership Function, Fuzzification, De-Fuzzification to Crisp Sets, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy rule generation (IF-THEN), Applications of Fuzzy Logic.

UNIT IV

Neuro-Fuzzy System: Introduction and Architecture of Neuro-Fuzzy Networks.

Introduction to different Optimization Techniques: Genetic Algorithm, Particle Swarm Optimization, Biogeography Based Optimization, Bacterial Forging Optimization, Detailed study of Genetic Algorithm, GA in problem solving, Implementation of GA.

Recommended Books

1. N. Yegnanarayana, 'Artificial Neural Network', PHI.
2. Laurene Fausett, 'Fundamental of Neural Networks', Pearson.
3. Simon Haykin, 'Neural Networks', Pearson.
4. S. Rajasekaran and G.A. Vijayalakshmi, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', PHI.
5. Timothy J. Ross, 'Fuzzy Logic with Engineering', John Wiley.
6. S.N. Sivanandam, 'Introduction to Fuzzy Logic using MATLAB', Springer.
7. Ahmad M. Ibrahim, 'Introduction to Applied Fuzzy Electronics', PHI.

DIGITAL CONTROL SYSTEM

Course Code: BECE3-562 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. To identify the different control system terminologies.
2. To describe the operation of digital control devices systems.
3. To study the different control systems using state variable methods.
4. To study stability analysis and analysis using state variable methods.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of stability, transfer function and terminologies of control systems.
2. Apply and analyze the principles of state feedback and state regulator.
3. Use various types of State Variable Methods for Digital Control Systems.

UNIT I

Introduction: Control system terminology, control theory history and trends, computer-based control. An overview of classical approach to analog controller design. Basic digital control scheme. Principles of signal conversion, Basic discrete time signals, Time domain models for discrete-time systems. Transfer function models, Stability on the Z-plane and jury stability criterion. Sampling as impulse modulation, Sampled spectra and aliasing. Filtering, choice of sampling rate, Principles of discretisation. Routh stability criterion on the r-plane.

UNIT II

Models of Digital Control Devices and Systems, Z-domain description of sampled continuous-time plants and systems with dead-time, Digital Controller design using direct synthesis procedures. Stability improvement by state feedback, Necessary and sufficient conditions for arbitrary pole-placement. State regulator design, Design of state observer. Compensator design by separation principle. Servo design. State feedback with integral control., Deadbeat control by state feedback and deadbeat observers.

UNIT III

Control System Analysis using State Variable Methods for Digital Control Systems: State variable representation, Conversion of state variable models to transfer function and of transfer function to canonical state variable models, Eigen values and Eigen vectors, Solution of state difference equations, controllability and Observability, Multi variable system.

UNIT IV

Lyapunov Stability Analysis: Basic concepts, Stability definitions and theorems, Lyapunov functions for linear and nonlinear systems, A model reference adaptive system. Parameter optimization and optimal control, Quadratic performance index, control configurations, State regulator design through the Lyapunov equation, Optimal state regulator through the Matrix Riccati-equation for digital control systems.

Recommended Books

1. B.C. Kuo,‘ Digital Control Systems’, Prentice Hall of India.
2. Sushil Das Gupta, ‘Automatic Control Systems’, Khanna Publishers.
3. M. Gopal, ‘Digital Control & State Variable Methods’, TMH.
4. M. Gopal, ‘Control System Principles & Design’, TMH.
5. K. Ogata, ‘Discrete-Time Control Systems’, Prentice Hall India.

MICROELECTRONICS

Course Code: BECE3-563 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

The student should be made to:

1. Know the characteristic of Integrated Circuits
2. Learn the basics of diffusion and photolithography.
3. Understand the concepts behind etching and annealing techniques.
4. Be familiar the various types of IC packages and assembly techniques

Course Outcomes:

At the end of the course, the student should be able to:

1. Characterize Integrated Circuits
2. Understand and Implementation of oxidation, diffusion and photolithography
3. Describe photo resist, annealing and etching techniques in IC fabrication.
4. Compare several of IC packages and assembly techniques

UNIT I

Introduction to Integrated Circuits and advantages, classification of integration, size and complexity of IC’s, Crystal Growth of Silicon: Electronic-Grade Silicon, Czochralski Crystal growth, Liquid Encapsulated Czochralski growth, Zone-refining and float zone growth, Bridgman growth of GaAs. Wafer preparation, Slicing and polishing, Epitaxy, VPE, MBE, MOCVD.

UNIT II

Oxidation, characterization of oxide films, diffusion, Diffusion, Fick's diffusion equation in one dimension, ion implantation, Rapid Thermal Annealing, Photolithography, E-beam lithography, optical lithography, and X-Ray lithography.

UNIT III

Photo resists: positive and negative photo resists, mask generation, wet and dry etching, Plasma and Rapid Thermal-Processing: Reactive Ion Etching technique, RTP for annealing, CVD and LPCVD techniques for deposition of poly silicon, silicon nitride and silicon dioxide, Metallization and patterning.

UNIT IV

VLSI process integration, process flows for CMOS and bipolar IC processes, Assembly techniques and Packaging of I.C's**,** packages Types, Packages using surface-mount-technology (SMT), Yield, reliability.

Recommended Books

1. S.M. Sze, 'VLSI Technology', Tata McGraw Hill.
2. Campbell, Stephen A., 'The Science and Engineering of Microelectronic Fabrication', Oxford Uni. Press.
3. S.K. Ghandhi, 'VLSI Fabrication Principles', John Wiley & Sons.

INSTRUMENTATION LAB.-II

Subject Code: BECE3-519 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measuring various electrical parameters using meters and transducers.
3. To study the characteristics of potentiometers, synchro set, dc and a.c. servo-systems.

Course Outcomes:

1. After the completion of the course, the students could have skills about the basic measurements of transducers, meters and servo systems.
2. An ability to use the techniques and skills to operate various meters, motors and transducers.

EXPERIMENTS

1. To determine output characteristic of a LVDT and determine its sensitivity.
2. Study characteristics of temperature transducer like Thermocouple, Thermistor and RTD with implementation of small project using signal conditioning circuit.
3. Study characteristics of Light transducer like Photovoltaic cell, Phototransistor and Pin Photodiode with implementation of small project using signal conditioning circuit.
4. To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
5. To study transmitter- receiver characteristics of a synchro set to use the set as control component.
6. To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.
7. To study the operation of an a.c. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.

8. To study a stepper motor and control its direction speed and number of steps with the help of a microprocessor.
9. Design & Performance of Instrumentation amplifiers and Active filters.
10. To study the performance of Strain Gauge & pressure transducers.

Note: Perform any 08 experiments from the above list of experiments.

MICROCONTROLLER LAB.

Subject Code: BECE3-520 **L T P C**
0 0 2 1

Course Objectives:

The student should be made to:

1. Introduce microcontroller concepts and features.
2. Implement assembly language programming for various applications
3. Introduce the practical concepts to control speed of DC and stepper motor.

Course Outcomes:

At the end of the course, the student should be able to:

1. Write programs for 8051 micro controller kit.
2. Understand programs for speed control of DC motor.
3. Understanding to control the speed of stepper motor.

EXPERIMENTS

1. Study of 8051/8031 Micro controller kits.
2. Write a program to add two numbers lying at two memory locations and display the result.
3. Write a program for multiplication of two numbers lying at memory location and display the result.
4. Write a Program to arrange 10 numbers stored in memory location in Ascending and Descending order.
5. Write a program to show the use of INT0 and INT1.
6. Write a program of Flashing LED connected to port 1 of the Micro Controller
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to interface the ADC.
9. Write a program to control a stepper motor in direction, speed and number of steps.
10. Write a program to control the speed of DC motor.
11. Interfacing of high power devices to Micro-controller port-lines, LED, relays and
12. LCD display.

Note: Perform any 08 experiments from the above list of experiments.

LINEAR INTEGRATED CIRCUITS LAB.

Subject Code: BECE3-521 **L T P C**
0 0 2 1

Course Objectives

1. To study the applications of op-amp as summing, scaling, averaging, instrumentation amplifiers, saw-tooth generator, zero-crossing detector and Schmitt trigger.
2. To study design of delay circuit using 555 timer and design a series regulator.

Course Outcomes

At the end of the course, the student should be able to:

1. Design oscillators and amplifiers using operational amplifiers.
2. Design filters using Op-amp and perform experiment on frequency response.
3. Analyze the working of voltage control oscillator.
4. Design DC power supply using ICs.

EXPERIMENTS

1. To study differential amplifier configurations.
2. To measure the performance parameters of an Op amp.
3. Application of Op amp as Inverting and Non Inverting amplifier.
4. To study frequency response of an Op Amp
5. To use the Op-Amp as summing, scaling & averaging amplifier.
6. To use the Op-Amp as Instrumentation amplifier
7. Design differentiator and Integrator using Op-Amp.
8. Application of Op Amp as Log and Antilog amplifier. Design Low pass, High pass and Band pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a delay circuit using 555 timer.
15. Design of a function generator
16. Design of a Voltage Controlled Oscillator

Note: At least 12 experiments are required to be performed.

SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C**
0 0 2 1

Course Objectives

The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.

Course Outcomes

At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration- Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

ANALYTICAL INSTRUMENTATION

Subject Code: BECE3-623 **L T P C** **Duration: 48 Hrs..**
3 1 0 4

Course Objectives:

The student should be made to:

1. Understand the electromagnetic radiation and spectrum.
2. Be familiar with the components of spectrometry and photometry.
3. Be exposed to the Nuclear magnetic resonance spectrometry and mass spectrometry.
4. Learn the various characterization techniques.

Course Outcomes:

At the end of the course, the student should be able to:

1. Identify the components required to understand electromagnetic radiation and spectrum
2. Understand the theoretical concepts of flame photometry, emission spectrometry and atomic absorption spectrometer.
3. Describe the principle and basic components of NMR and mass spectrometry.
4. Learn the various characterization techniques like SEM, TEM etc.

UNIT I (12 Hrs.)

Introduction to electromagnetic Radiation & spectrum and interaction of radiation with matter. Laws relating to Absorption of Radiation; Beer Lamberts law, Ultraviolet (UV) and Visible absorption instruments components. UV and Visible instruments: spectro photo-meters: single and dual beam. Infra-Red (IR) spectrophotometers: basic components, types, Fourier transform techniques.

UNIT II (12 Hrs.)

Emission spectrometry: Theoretical concepts, instrumentation: source unit, electrodes. Direct reading multichannel spectrometers. Flame photometry: principle, constructional details, fuel gases, atomizer, burner, optical and recording systems. Atomic absorption spectrometers: theoretical concepts, instrumentation: hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems.

UNIT III (12 Hrs.)

Nuclear magnetic resonance (NMR) spectrometry: principle, nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details, spin decoupler, Fourier transform NMR spectroscopy. Electron spin resonance (ESR) spectrometry: principle and constructional details. Basic principle of chromatography – Gas & Liquid column chromatograph.

Mass spectrometry: basic components, types (magnetic deflection type, time of flight, double focusing, quadrupole, gas chromatograph mass spectrometer (GCMS) system,

UNIT IV (12 Hrs.)

Characterization Techniques: Construction, principle and working of Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), Transmission Electron Microscope (TEM) and X-Ray Diffractometer (XRD).

Recommended Books

1. R.S. Khandpur, 'Handbook of Analytical Instrumentation', Tata McGraw-Hill.
2. Willard, Merrit and Dean, 'Instrumental Methods of Analysis', CBC Publishers.
3. E.W. Ewing, 'Instrumental Methods of Chemical Analysis', McGraw Hill.
4. Bharat Bhushan, 'Handbook of Nanotechnology', Springer.
5. P.J. Goodhew and F.J. Humphreys, 'Electron Microscopy and Analysis', Taylor & Francis.
6. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, 'Basic Science and Emerging Technologies', Overseas Press.

OPTO ELECTRONICS INSTRUMENTATION

Subject Code: BECE3-624 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To inculcate understanding of the basics required for optical components.
2. To deal with the issues of the light transmission through a fiber.
3. To instill knowledge on optical fiber measurements.
4. To deal with fiber optic sensors and other fiber optical application

Course Outcomes:

Upon completion of the course, students will be able to:

1. Explain the nature of light, black body radiation and optical components.
2. Describe the modes of fibers and losses in optical fiber.
3. Analyze the various parameters required for the measurement of optical fiber.
4. Illustrate various fiber optic sensors.

UNIT I (12 Hrs.)

Nature of light, wave nature of light, light sources black body radiation, units of light. Optical components; Prisms, Filters, Monochromators, Diffraction Gratings, Holographic Gratings. Light Sources; Discharge lamps, Nernst lamp, Incandescence lamp, Globar, Led and Laser. Light Detectors: Photovoltaic, photo detector, photo diode array & APD.

UNIT II (12 Hrs.)

Principle of light transmission through a Fiber. Classification of optical fibers; Single Mode and Multi-Mode Fibres, Step Index and Graded Index Fibres. Losses in Optical Fibers; Absorption, Scattering and Dispersion. Optical Windows for Fiber Optic Transmission system.

UNIT III (12 Hrs.)

Optical Fiber Measurements: N.A. measurement, working of OTDR, microprocessor based OTDR, applications of OTDR, dispersion measurements, Bit Error Rate (BER) measurement, attenuation measurement using OTDR, cut off wavelength measurement, micro bending loss measurement. Splicing of fibers.

UNIT IV (12 Hrs.)

Fiber Optic Sensors, intensity modulated sensors, microben strain intensity modulated sensor, liquid level types hybrid sensor, internal effect intensity modulated sensor, phase sensor, diffraction grating sensors, sensors using single mode fiber, inter ferometric temperature sensor, distributed fiber optic sensors.

Optical Fiber Applications in the field of Communication, LAN and Medical diagnostic.

Recommended Books:

1. Optical Fibers & Fiber Optic Communication systems by Subir Kumar Sarkar, S. Chand & Co.
2. Opto electronics: Fiber Optics and Lasers by Morris Tischler, A Lab Text Manual, McGraw Hill.
3. Fiber Optics Handbook for Engineers & Scientist (Optical & Electro-optical Engineering Series), by Frederick C. Allard, McGraw Hill.
4. Optical Fiber Communications, Principles & Practice by John M. Senior, Prentice Hall of India.
5. Optical Fiber Communications by Gerd Keiser, McGraw-Hill International.
6. Optical Fiber Communications, Principles & Practice by John M. Senior, Pearson Publishers.

SIGNAL AND SYSTEMS

Subject Code: BECE3-625 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
3. To impart them knowledge of various types of noises.

Course Outcomes:

1. An ability to analyze various types of signals in communication system.
2. Developing skills to understand random signals.
3. To understand various types of noises.
4. Understand signal transmission through linear networks.

UNIT-I (12 Hrs.)

Systems and Signal Analysis: Detailed Classification of Signals and Systems, Fourier Series and its properties, Fourier transform and its properties along with applications, Discrete Time Fourier Series (DTFS) and Discrete Time Fourier Transform (DTFT).

Correlation and Spectral Density: Definition of Correlation and Spectral Density, Analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

UNIT-II (12 Hrs.)

Random Signal Theory: Introduction to Probability Theory, Definition of Probability of Random Events. Joint and Conditional Probability, Probability Mass Function, Statistical Averages. Probability Density Functions (PDF) and Statistical Averages, mean, moments and expectations, standard deviation and variance. Probability models: Uniform, Gaussian, Binomial. Examples of PDF, Transformation of Random Variables. Random Processes, Stationary and Ergodicity.

UNIT-III (12 Hrs.)

Introduction to Noise: Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure. Experimental determination of Noise Figure, Pulse Response and Digital Noise and its elimination.

UNIT-IV (12 Hrs.)

Signal Transmission Through Linear Networks: Convolution Theorem and its graphical interpretation. The Sampling Theorem, Low Pass and Band Pass Networks, Matched Filter, Enveloped detector.

Recommended Books

1. B.P. Lathi, 'Digital and Analog Communication Systems', Oxford University Press.
2. Ravi Kumar, 'Signals and Systems', PHI Course.
3. Simon Haykin, 'Signals and Systems', Wiley.
4. D. Ganesh Rao and Satish Tunga, 'Signals and Systems', Pearson.

NANO SCIENCE AND NANO-TECHNOLOGY

Subject Code: BECE3-664 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To create awareness about nanotechnology issues.
2. To impart knowledge about carbon age and nano tubes.
3. To create awareness about Quantum computing**.**
4. To study the various characterization techniques in nano-electronics

Course Outcomes:

Students shall be able to

1. Understand the fundamentals and basics of nanotechnology.
2. Understand significance and potential opportunities to create better materials and products.
3. Describe different nano-scale devices.

UNIT I (12 Hrs.)

Basics and Scale of Nanotechnology: Introduction – Scientific revolutions – Time and length scale in structures, Definition of a nano-system, Top down and bottom up approaches – Evolution of band structures and Fermi surface – introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, Dimensionality and size dependent phenomena – Fraction of surface atoms – Surface energy and surface stress.

UNIT II (12 Hrs.)

The Carbon Age and Nanotubes: New forms of carbon, Types of nanotubes, Formation of nanotubes, methods and reactants- Arcing in the presence of cobalt, Laser method, Chemical vapor deposition method, ball milling, properties of Nanotubes Electrical properties, vibrational properties, Mechanical properties, applications of Nanotubes in electronics, hydrogen storage, materials, space elevators.

UNIT III (12 Hrs.)

Characterization Techniques in Nano-electronics: Principle, construction and working: Electron microscopy (SEM and TEM), Infrared and Raman Spectroscopy, Photoemission and X-RD spectroscopy, AFMs, Magnetic force microscope.

UNIT IV (12 Hrs.)

Nano-scale Devices: Introduction: Quantum Electron Devices; High Electron Mobility Transistor, Quantum Interference Transistor, Single Electron Transistor and Carbon Nanotube Transistor, DNA Computing; Structure of DNA, Basic Operation on DNA and DNA Computer.

Recommended Books

1. C.P. Polle and F.J. Owens, 'Introduction to Nanotechnology', Willey India Pvt. Ltd.
2. Daniel Minoli, 'Nanotechnology Applications to Telecommunications and Networking', Willey India Pvt. Ltd.
3. Manasi Karkare, 'Nano Technology: Fundamentals and Applications', I.K. International Pvt. Ltd.
4. Lynn E. Foster, 'Nano Technology', Pearson India.

INTERNET OF THINGS

Subject Code: BECE3-665 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives

1. To aware the students about the internet and networking basis.
2. To provide the basic concepts of internet of things (IoT) platforms.
3. To impart knowledge about IoT architecture and application development.
4. To study case studies and advance IoT applications.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of OSI model, data transfer and network topologies.
2. Apply and analyze the principles wired and wireless networking equipment.
3. Use various types of IoT architectures and web of things
4. Understand the home and commercial applications of IoT.

UNIT-I (10 Hrs.)

Internet/Web and Networking Basics: OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing

UNIT-II (12 Hrs.)

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of

Wireless Networking equipment's – Access Points, Hubs etc. Linux Network Configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

UNIT-III (12 Hrs.)

IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis the Architecture the Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN, Security aspects in IoT

IoT Application Development: Application Protocols: MQTT, REST/HTTP, CoAP, MySQL 13 36 /85

UNIT-IV (14 Hrs.)

Back-end Application Designing: Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object Type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools.

Case Study & Advanced IoT Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Recommended Books

1. Zach Shelby, Carsten Bormann, 'The Wireless Embedded Internet', Wiley.
2. Ovidiu Vermesan, Peter Friess, 'Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems', River Publishers.
3. Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, 'Interconnecting Smart Objects with IP: The Next Internet'.
4. Lu Yan, Yan Zhang, Laurence T. Yang, HuanshengNing, 'The Internet of Things: From RFID to the Next-Generation Pervasive Networked'.
5. Vijay Madisetti, Arshdeep Bahga, 'Internet of Things (A Hands-On-Approach).

INFORMATION THEORY AND CODING

Subject Code: BECE3-666 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To aware the students about the information theory.
2. To provide the basic concepts of channel capacity.
3. To impart knowledge about linear block codes.
4. To study convolution and BCH codes.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of entropy, mutual information and divergence.
2. Apply and analyze the principles of channel capacity.
3. Use various types of check metrics, linear and cyclic codes.
4. Understand working principle of BCH and convolution codes.

Unit-I (12 Hrs.)

Information Theory: Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality, Divergence, Properties of Divergence, Divergence

Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information.

Unit-II (12 Hrs.)

Channel Capacity: Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of the all these channels, Channel Coding Theorem, Shannon-Hartley Theorem.

Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding.

Unit-III (12 Hrs.)

Linear Block Codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes. Cyclic Codes, BCH codes

Unit-IV (12 Hrs.)

Decoding of BCH Codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm.

Convolution codes: Viterbi decoding algorithm, Turbo Codes, Concatenated Codes.

Recommended Books

1. Arijit Saha, 'Information Theory, Coding & Cryptography', Pearson Education.
2. Ranjan Bose, 'Information Theory, Coding and Cryptography', Tata McGraw Hill.
3. Thomas M. Cover, Joy A. Thomas, 'Elements of Information Theory', Wiley India Pvt.
4. J. Mary Jones, 'Information and Coding Theory', Springer.

OPTICAL FIBER COMMUNICATION

Subject Code: BECE3-667 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To Facilitate the knowledge about optical fiber sources and transmission techniques
2. To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA.
3. To explore the trends of optical fiber measurement systems.

Course Outcomes:

1. Upon completion of the course, students will be able to:
2. Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
3. Explain the various optical sources and optical detectors and their use in the optical communication system.
4. Analyze the digital transmission and its associated parameters on system performance

UNIT-I (12 Hrs.)

Introduction to Optical Communication Systems: Electromagnetic spectrum used for optical communication, block diagram of optical communication system. Basics of transmission of light rays, Advantages of optical fiber communication.

Optical Fibers: Optical fibers structures and their types, fiber characteristics: attenuation, scattering, absorption, fiber bend loss, dispersion, fiber couplers and connectors

UNIT-II (12 Hrs.)

LED Light Source: Light emitting diode: recombination processes, the spectrum of recombination radiation, LED characteristics, internal quantum efficiency, external quantum efficiency, LED structure, lens coupling to fiber, behavior at high frequencies.

UNIT-III (12 Hrs.)

LASER Light Source: Basic principles of laser action in semi -conductors, optical gain, lasing threshold, laser structures and characteristics, laser to fiber coupling, comparison with LED source.

UNIT-IV (12 Hrs.)

Avalanche and PIN Photo Detectors: Principles of optical detection, quantum efficiency, responsivity, general principles of PIN photodetector, intrinsic absorption, materials and designs for PIN photodiodes, impulse and frequency response of PIN photodiodes, noise in PIN Photodiodes, multiplication process, APD Design, APD bandwidth, APD noise.

Recommended Books

1. John M Senior, 'Optical Fiber Communications', PHI.
2. Tata McGraw Hill, Gerd Keiser, 'Optical Fiber Communications'.
3. John Gowar, 'Optical Communication Systems', PHI.
4. Selvarajan, Kar, Srinivas, 'Optical fiber Communication', Tata McGraw Hill.

ANALYTICAL INSTRUMENTATION LAB.

Subject Code: BECE3-626 **L T P C**
0 0 2 1

Course objectives:

1. To introduce the students about the theoretical concepts associated with pH measurement.
2. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various gases.
3. To impart them knowledge of fluoride and moisture contents.

Course Outcomes:

1. Developing skills to measure pH using pH meter.
2. To understand viscosity and strength of solutions.
3. Understand the concept of fluoride and moisture contents

EXPERIMENTS

1. pH measurement of a given sample on microprocessor based pH meter.
2. To estimate the concentration of given sample in a given solution (PPM) on flame photometer.
3. To measure the viscosity of given solution.
4. To measure the strength of oxygen dissolved (PPM) in a given solution.
5. To analyse a given gas using gas analyser.
6. To determine fluoride content in a given sample using fluoride meter.
7. To determine moisture content in a given sample using Karl Fischer Titrator.

Note: At least 07 experiments are required to perform.

INDUSTRIAL LAB.

Subject Code: BECE3-627 **L T P C**
0 0 2 1

Course Objectives:
The student should be made to:
1. To introduce Programmable logic controllers concepts and features.
2. To introduce the practical concepts of Distributed control system and SCADA.
3. To introduce the functioning of relays and sensors

Course Outcomes:
At the end of the course, the student should be able to:
1. Write basic programs using ladder programming
2. Analyze the application of Distributed control systems.
3. Understand Functioning of different relays and sensors

EXPERIMENTS

1. To understand Programmable logic controllers
2. To implement basic programmes using Ladder programming
3. To implement basic logics using statement lists
4. To overview about SCADA.
5. To acquire knowledge about Distributed control system.
6. Temperature controller using Distributed control system.
7. Pneumatics controller using Distributed control system
8. Level control using Distributed control system.
9. Functioning of different relays and sensors
10. To understand different diagrams representation in Industry.

Note: At least 08 experiments are required to perform.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C**
0 0 2 1

Course Objectives
The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes
At the end of the course, the student will be able to:
1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation

skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

BIOMEDICAL INSTRUMENTATION

Subject Code: BECE3-728 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To identify the various biomedical instruments and their characteristics.
2. To learn about the Therapeutic equipment and central nervous system.
3. To study the different ultrasound and medical imaging systems.
4. To study safety parameters of biomedical instruments.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of biomedical instruments and bioelectric signals.
2. Apply and analyze the principles of Therapeutic equipment and central nervous system.
3. Describe the various types of biomedical imaging systems.
4. Understand sources of noise and safety parameters of biomedical equipment.

UNIT I (12 Hrs.)

Introduction to Biomedical Instrumentation: Sources of bio medical potentials. Different bioelectric signals like ECG, EMG & EEG. Bio potential electrodes: basic electrode theory, nearest equation, electrical conductivity of electrode jellies & creams, skin contact impedance & its measurement. Electrodes for ECG, EEE & EMG. Cardiovascular system: physiology of heart & cardio vascular system, ECG lead configuration, ECG recorders, Vector cardiograph, Phonocardiograph, measurement of cardiac output, blood flow & blood pressure.

UNIT II (12 Hrs.)

Central Nervous System: Anatomy of nervous system, neuronal communication, neuronal receptors. The sematic nervous system & spinal reflexes. Neuronal firing measurements, EEG measurements, Recorder for EEG & EMG. Therapeutic equipment: cardiac pacemakers, cardiac de fibrillators, nerve & muscle stimulators, Diathermy: shortwave, UV & ultrasonic.

UNIT III (12 Hrs.)

Medical Imaging System: Instrumentation for Diagnostics-Ray: properties, X-ray units, X-ray machines & generation process, special imaging techniques for X-rays. Ultrasonic Imaging System: Physics of ultrasound, basic modes of transmission, ultrasonic display modes: A scan, B scan & M scan with applications. Biological effects of ultrasound.

UNIT IV (12 Hrs..)

Electrical Safety: General consideration for biomedical recorder amplifiers, sources of noise in zero level recording circuits, physiological effects of electrical currents, electric shock hazards, leakage currents, methods of accident prevention. Test instruments for checking safety parameters of biomedical equipment.

Recommended Books

1. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', Tata McGraw Hill.
2. L. Cromwell, F. Weibell, E.A. Pfciffer, 'Biomedical Instrumentation & Measurements', PHI.
3. Carr & Brown, 'Introduction to Biomedical Equipment', McGraw Hill.
4. J.G. Webster, 'Medical Instrumentation', 3rd Edn., John Wiley.

PROCESS CONTROL

Course Code: BECE3-729 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To identify the various process variables and mathematical modeling.
2. To learn about the controlling modes of process control.
3. To study the different types of actuators.
4. To study various advanced control schemes.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand need and application of mathematical modeling.
2. Realize and analyze the control modes.
3. Describe the various types of actuators used in process control.
4. Understand the different advanced control schemes.

UNIT I (12 Hrs.)

Introduction: Incentives of process control, Synthesis of control system. Classification and definition of process variables.

Mathematical Modelling: Need and application of mathematical modelling, Lumped and distributed parameters, Analogies, Thermal, Electrical and chemical systems, Modelling of CSTR, modelling of heat exchanger, Interacting and non-interacting type of systems, Dead time elements, Developing continuous time and discrete time models from process data.

UNIT II (12 Hrs.)

Control Modes: Definition, Characteristics and comparison of on-off, Proportional (P), Integral (I), Differential (D), PI, PD, PID, Dynamic behavior of feedback controlled processes for different control modes, Control system quality, IAE, ISE, IATE criterion, tuning of controllers Ziegler-Nichols, Cohen-Coon methods, Controller troubleshooting.

Realization of Control Modes: Realization of different control modes like P, I, D, In Electric, Pneumatic, Hydraulic controllers.

UNIT III (12 Hrs.)

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, Control valves, Types, Functions, Quick opening, Linear and equal percentage valve, Ball valves, Butterfly valves, Globe valves, Pinch valves, Valve application and selection, Cavitation and flashing, Dampers and variable speed Drives.

UNIT IV (12 Hrs.)

Advanced Controls: Introduction to advanced control schemes like Cascade, Feed forward, Ratio, Selective, Override, Split range and Auctioneering control, Plant wide control.

Recommended Books

1. C.D. Johnson, 'Process Control Instrumentation Technology', PHI.
2. Krishan Kant, 'Computer based Industrial Control', PHI.
3. Andrew Parr, 'Pneumatic & Hydraulic', PHI.
4. D. Considine, 'Process Industrial Instruments & Control Handbook', McGraw Hill.
5. B.G. liptak, 'Instrument Engineers Handbook', CRC Press.

VLSI DESIGN

Subject Code: BECE3-768 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. In this course, the MOS circuit realization of the various building blocks that is common to any digital VLSI circuit is studied.
2. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.

Course Outcomes:

Upon completion of the course, students should

1. Explain the basic CMOS circuits and the CMOS process technology.
2. Discuss the techniques of chip design using programmable devices.
3. Model the digital system using Hardware Description Language.

UNIT-I (12 Hrs.)

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture Declaration Introduction to behavioral, dataflow and structural models

VHDL Statements: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

UNIT-II (12 Hrs.)

Applications of VHDL: Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.

UNIT-III (12 Hrs.)

Review of MOS Devices: MOS Structure, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations MOS Transistor Models. NMOS, PMOS, CMOS.

Basic Electrical Properties and Circuit Concepts: The NMOS Inverter and Transfer Characteristics pull up and pull down ratios of NMOS, alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Driving large Capacitive loads, Propagation delays and effect of wiring capacitance.

UNIT-IV (12 Hrs.)

Circuit Characterization and Performance Estimation: Estimation of R, C, L, Switching Characteristics-delay models. Power dissipation. Scaling of MOS circuits. Effect of device scaling on circuit performance.

Recommended Books

1. Bhasker, 'A. VHDL Primmer', Prentice Hall.
2. Weste and Eshrighian, 'Principle of CMOS VLSI Design', Pearson Education.
3. D.A. Pucknell and K. Eshraghian, 'Basic VLSI Design', Prentice Hall India, New Delhi.
4. Brown and Vranesic, 'Fundamentals of Digital Logic with VHDL Design', Tata McGraw Hill.
5. S.M. Kang, Y. Lebiebici, 'CMOS Digital Integrated Circuits Analysis & Design', Tata McGraw Hill.

POWER PLANT INSTRUMENTATION

Subject Code: BECE3-769 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To identify the various process of thermal power plant.
2. To learn about the boiler and turbine instrumentation.
3. To study the automation strategy of thermal power plant.
4. To study hydroelectric power generation and regulation.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand comparison between thermal, hydro, nuclear power plant.
2. Analyze the different parameters of boiler and turbines.
3. Describe the PLC, DCS, SCADA strategies of industrial automation.
4. Understand the different hydraulic and nuclear power generators.

UNIT I (12 Hrs.)

Thermal Power Plant: Unit overview, types of boilers, turbine generators, condensers, variable speed pumps and fans, material handling system. Comparison of thermal, hydro, nuclear power plant, boiler safety standards, boiler inspection procedures.

UNIT II (12 Hrs.)

Boiler & Turbine instrumentation: Control and optimization, combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, Oxygen/CO/CO2 furnace

draft, electrical megawatt controls, boiler interlocks, sequence event recorder, supervisory control, data acquisition systems, burner management systems and controllers.

Turbine Instrumentation: Speed calculation, valve actuation, auto-start-up, thermal stress control, condition monitoring and power distribution instrumentation.

UNIT III (12 Hrs.)

Automation strategy of thermal power plant (PLC, DCS, SCADA) and open system application, block schematic, control equipment, boiler automation, diagnostic functions and protection, digital electro hydraulic governor, man-machine interface, software system, graphic display of automated power plant application functions, variable pressure control.

UNIT IV (12 Hrs.)

Hydroelectric power generation, regulation and monitoring of voltage and frequency, pollution and effluent monitoring and control. Nuclear power generation and control station.

Recommended Books

1. Payne and Thompson, 'Efficient Boiler Operation Source Book', The Fairmont Press.
2. Popovic & Bhatkar, 'Distributed Computer Control for Industrial Automation', Marcel Dekker.
3. Dickinson and Cheremisinoff, 'Solar Energy Technology', Vol. I, II, Marcel Dekker, CRC Press.
4. Krishna Kant, 'Computer Based Industrial Control', PHI.
5. Energy Management Handbook by W.C.Turner, John willey & Sons .
6. Energy Technology Handbook by D.M.Considine, Tata McGraw Hill.
7. B.G. Liptak, 'Process Control', CRC Press.

BASICS OF SOCIAL SCIENCE, ECONOMICS AND INDUSTRIAL MANAGEMENT

Subject Code: BECE3-770 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To study the several aspects of social change
2. To learn about nature and scope of economics.
3. To study about the difference of management and administration.
4. To study marketing management and total quality management.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand the processes of social change.
2. Analyze the different parameters of industrial economics.
3. Describe the entrepreneurial qualities, skills, role of government, financing agencies
4. Understand the marketing management and total quality management

Unit I (12 Hrs.)

Meaning of social change, nature of social change, theories of social change. The direction of social change, the causes of social change, the process of social change. Factors of social change - the technological factors, the cultural factors, the effect of technology on major social institutions, social need of status system, social relations in industry.

Unit II (12 Hrs.)

Nature and Scope of Economics: Special significance of economics to engineers. Meaning of Industrial Economic, production function and its type; least cost combination, law of variable

proportion, law of return increasing, constant and diminishing. Fixed and variable costs in short run and long run, opportunity costs, relation between AC and MC, U shaped short run AC curve. Price and output determination under monopoly in short run and long run. Price discrimination, price determination under discriminating monopoly. Comparison between monopoly and perfect competition.

Unit III (12 Hrs.)

Meaning of Management: Characteristics of management, management versus administration, management-art, science and profession, Fayol's principles of management. Personal management - meaning and functions, manpower – process of manpower planning, recruitment and selection – selection procedure. Training – Objectives and types of training, various methods of training. Labour legislation in India – main provisions of industrial dispute & act 1947. Industrial ownership: types, single partnership, JSC, cooperative, public sector, private sector, merits & demerits. Entrepreneurial qualities, skills, role of government, financing agencies.

Unit IV (12 Hrs.)

Marketing Management: Definition and meaning, scope of marketing management, marketing research meaning, objectives. Purchasing management – meaning and objectives, purchase procedure, inventory control techniques. Financial management- Introduction, objectives of financial decision, source of finance. Quality management: Concepts and applications of Kaizen, quality circle, ISO 9000series, just-in-time, quality planning and total quality management, elements of TQM, quality circles.

Recommended Books

1. K.P. Sundharam and E.N. Sundharam, 'Economic Analysis', Sultan Chand & Sons.
2. M.L. Jhingam, 'Micro Economic Theory', Konark Publishers Pvt. Ltd.
3. M.L. Seth, Lakshami Narain Aggarwal, 'Principles of Economics', Educ. Pub. Agra.
4. D.R. Sachdeva and Vidya Bhusan, 'An Introduction to Sociology', Kitab Mahal Pub.
5. R.D. Aggarwal, 'Organization and Management', Tata McGraw Hill.
6. N.C. Shukla, 'Business Organization and Management', Sultan Chand & Sons.

DIGITAL SYSTEM DESIGN

Subject Code: BECE3-771 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
2. To introduce the concept of memories and programmable logic devices.
3. To illustrate the concept of synchronous and asynchronous sequential circuits

Course Outcomes:

Students will be able to:

1. Design and implement Combinational circuits.
2. Design and implement synchronous and asynchronous sequential circuits.
3. Write simple HDL codes for the circuits.

UNIT-I (12 Hrs.)

Introduction to Digital Design Concepts: Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals.

Clocked Sequential Finite State Machines: State diagram, analysis of synchronous circuits, derivation of state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, serial data code conversion, design of synchronous sequential state machine, design and applications of counters and shift registers.

UNIT-II (12 Hrs.)

Multi-input System Controllers Design: System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling.

Sequential Design using LSI & MSI circuits: Using decoders, multiplexers in sequential circuits, sequential network design using ROMs, PLAs and PALs, Programmable gate Arrays (PGAs).

UNIT-III (12 Hrs.)

Asynchronous Sequential Finite State Machines: Introduction, analysis of asynchronous networks, races and cycles, derivation of primitive flow tables, reduction of primitive flow tables, state assignments, hazards, asynchronous sequential network design.

UNIT-IV (12 Hrs.)

VHDL: Basic Language Elements, Data objects, classes and data types, operators, overloading, logical operators, VHDL representation of Digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models.

Recommended Books

1. William I. Fletcher, 'An Engineering Approach to Digital Design', PHI.
2. M. Morris Mano, 'Digital Design', Pearson Education.
3. Z. Navabi, 'VHDL Analysis and Modeling of Digital Systems', McGraw Hill.
4. Kevin Skahill, 'VHDL for Programmable Logic', Pearson Education.
5. Jr. Charles H. Roth, 'Fundamentals of Logic Design', Jaico Publishers.
6. John Wakerly, 'Digital Design, Principles and Practices', Pearson Education.

PROCESS CONTROL LAB.

Subject code: BECE3-730 **L T P C**
0 0 2 1

Course Objectives:

To get practical knowledge of process control based systems, programmable logic controller, Fuzzy Controller, and software based PLC operation.

Course Outcomes:

1. To familiarize with PID control & its tuning procedures.
2. To experiment various functions of a Fuzzy Controller.
3. To practice various process control based pressure and level control system.

EXPERIMENTS

1. To study the control valve, shuttle valve and logic valve on pneumatic trainer.
2. To study PID control & its tuning procedures on a furnace.
3. To study the functioning of a Fuzzy Controller.
4. To study the operation of programmable logic controller.
5. To study the effect of cascade control in temp and flow system.
6. To study the effect of forward control in temp and flow system.
7. To study the process control based pressure control system.

8. To study the process control operation in level control.
9. To study distribution process control in temp process and level system.
10. To study the supervisory control in process control.
11. To study of a Software-based PLC operation.

Note: At least 10 experiments are required to be performed.

MINOR PROJECT

Subject code: BECE3-732 **L T P C**
0 0 4 4

The students are required to undergo Minor Project work and it will be evaluated by the external examiner and one internal examiner appointed by the institute/university. External examiner will be from panel of examiners. Assessment of project will be based on Quality of work, Seminar, viva-voice, report writing. Students can use different hardware and software in order to analyse and verify the results.

VIRTUAL INSTRUMENTATION

Subject Code: BECE3-833 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To study the basic concept of virtual instrumentation.
2. To learn various programing methods of virtual instrumentation.
3. To know the characteristics of data acquisition system.
4. To understand various application of virtual instrumentation.

Course Outcomes:
Upon completion of the course, students will be able to
1. Explore historical perspective and architecture of virtual instrumentation
2. Understand programing methods and analysis tools of virtual instrumentation.
3. Analyze the field of data acquisition system.
4. Learn about various applications of virtual instrumentation.

UNIT I (12 Hrs.)

Introduction to Virtual Instrumentation: Definition of virtual instrumentation, need & advantage of virtual instrumentation, historical perspective of virtual instrumentation. Block diagram & architecture of V.I., data flow techniques, graphical programming in data flow & comparison of conventional programming.

UNIT II (12 Hrs.)

Programming Methods: VIS & sub VIS, loops& charts, arrays, cluster, graphs, sequence & structure, formula modes, local and global variables, string& file inputs. Analysis tools: Fourier transforms, power spectrum, correlation methods, windowing &filtering.

UNIT III (12 Hrs.)

Data Acquisition Systems: ADC, DAO, DIO, ccounters & timers, PC hardware structures, timing, interrupts, DMA, software& hardware installations. Current loops, RS 232/RS 485, GPIB,system basics,

interface basics, USB, PCMIA,VXI,SCXI,PXI etc., networking basics for office & industrial application VISA & VI , image acquisition & processing , motion control.

UNIT IV (12 Hrs.)

Application of Virtual Instrumentation: Application in process control, Laboratory equipments: Oscilloscope, digital multi meter, Pentium computer, lab view software. Study of data acquisition & control using lab view. Virtual instrumentation for an innovative thermal conductivity apparatus to measure the thermal conductivity.

Recommended Books

1. Gary Johnson, 'Labview Graphical Programming', 2nd Edn., McGraw Hill, New York.
2. Lisa K. Wells & Jeffrey Travis, 'Labview for Everyone', Prentice Hall, New Jersey.

PROGRAMMABLE LOGIC CONTROLLER

Subject Code: BECE3-872 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To outline the formal procedures for the analysis of PLC
2. To introduce the commands and functions of PLC
3. To illustrate the concept of advance functions.

Course Outcomes:

Students will be able to:

1. Understand the need for automation in process industries
2. Learn about the various technologies used in process automation.
3. Learn programming of PLC.

UNIT I (10 Hrs.)

Introduction to PLC: Evolution Advantages/Disadvantages: system description, internal operation of CPU and I/C modules, installation &testing.

Programs & Software: General programming procedures, registers and Addresses, Relation of Digital Gate Logic to contact logic.

UNIT II (14 Hrs.)

Basic PC Functions: Programming, On-Off inputs to produce on – off outputs: Timers, Counters: Auxiliary Commands &functions.

UNIT III (12 Hrs.)

Intermediate Functions: Arithmetic functions, Number Comparison functions, The skip & master control relay functions.

Functions involving individual register bits: Utilizing digital bits, the sequences functions, Matrix functions.

UNIT IV (12 Hrs.)

Advanced Functions: Controlling a robot with a PC; Analog PC operator, Immediate update, select continuously, ascending sort, transmit print, FIFO, LIFO & Loop Control.

Recommended Books:

1. C.D. Johnson, 'Process Control Instrumentation Technology', PHI.
2. Krishan Kant, 'Computer Based Industrial Control', PHI.
3. Andrew Parr, 'Pneumatic & Hydraulic', PHI.
4. D. Considine, 'Process Industrial Instruments & Control Handbook', McGraw Hill.

5. B.G. Liptak, 'Instrument Engineers Handbook', CRC Press.

REMOTE SENSING AND THERMAL IMAGING

Subject Code: BECE3-873 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:
1. To outline the formal procedures for the basics and history of remote sensing
2. To introduce the concept of Microwave Remote Sensing.
3. To illustrate the concept of Thermal Imaging system.
4. To study Meteorological satellite characteristics and their orbits

Course Outcomes:
Students will be able to:
1. Describe the principles and history of remote sensing.
2. Illustrate platforms and remote sensing sensors.
3. Learn electromagnetic spectrum, and atmospheric transmission for thermal imaging system.
4. Understand applications, future trends and research in remote sensing.

UNIT I (12 Hrs.)

Basics of Remote Sensing: Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities: Nomenclature and Units Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltzmann law), Interaction of EMR with the Earth Surface (Wien's displacement law, Kirchhoff's Law) Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

UNIT II (12 Hrs.)

Platforms and sensors: Platforms, Remote sensing sensors, resolutions Across track and along the track scanning, Optical sensors, Thermal scanners Microwave sensing radar satellite missions. Land sat series, SPOT series, IRS satellite series, IKNOS.

Microwave Remote Sensing: Airborne and Space borne radar systems basic instrumentation. System parameters: Wave length, Polarization, Resolutions, Radar geometry. Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckie radiometric calibration, Radar Grametry, Introduction, Mosaicing Stereoscope.

UNIT III (12 Hrs.)

Thermal Imaging system: Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, Apparent thermal inertia, Thermal diffusivity. IR - radiometers, Airborne and Satellite TTR scanner system Characteristics of IR images: Scanner distortion, image irregularities, Film density and recorded & Temperature ranges. Effects of weather on images; Clouds, Surface winds and Penetration of smoke plumes. Interpretation of thermal imagery.

UNIT IV (12 Hrs.)

Meteorological Satellites: Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS, SEASAT, GOES, METEOSAT, INSAT**.** Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites. Applications of remote sensing: Geology, Forestry, Land use, Soils etc. Future trends and Research.

Recommended Books

1. W. Travelt , 'Imaging Radar for Resource Survey: Remote Sensing Applications', Chapman & Hall.
2. P.H. Swain and S.M. Davis, 'Remote Sensing: The Quantitative Approach', McGraw Hill.
3. Floyd, F. Sabins, 'Remote Sensing Principles and Interpretation', Jr. Freeman and Co. San Franscisco.
4. 'Applied Remote Sensing C.P.L.O.', Longman Scientific and Technical Publishers.
5. E.C. Barrett & L.F Curtis, 'Introduction to Environmental Remote Sensing', Chapman and Hall, London.
6. George Joseph, 'Fundamentals of Remote Sensing', Universities Press.

ADVANCE PHOTONICS

Subject Code: BECE3-874 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To understand the various photonics concepts.
2. To introduce the concept of wave optics.
3. To illustrate the concept how propagation of light in confined geometries is done.

Course Outcomes:

Students will be able to:

1. Understand various photonics concepts.
2. Understanding of wave optics.
3. Propagation of light through various geometries.

UNIT I (12 Hrs.)

Introduction to Photonics – Nature of Light – Wave and light terminology, Maxwell equation, light spectra and sources, absorption and emission, black body radiation. Geometric Optics – Light as a ray, law of reflection including plane mirrors, law of refraction including optical fiber applications, prisms and thin lenses including Lens maker's equation, Lens problems and optical instruments using the thin lens equation.

UNIT II (12 Hrs.)

Wave Optics – wave descriptive terminology, wave superposition (interference) including double – slit interference, diffraction and diffraction gratings, interference applications, e.g. Michelson, Mach Zender and Fabry Perot interferometers, Thin film interference and Fiber Bragg Gratings. Diffraction Effects including: airy disk, near far field effects. Polarization principles including scattering, reflection and birefringence.

UNIT III (12 Hrs.)

Propagation of light in confined geometries, planar waveguides, Optical fibers and their design, Linear and Nonlinear wave propagation in Fibers, Optical Solitons, Directional couplers, Fiber Bragg gratings, Fiber-optic communication systems. Generation of light in semiconductors, Electroluniscence, p-n junction and hetrostructure LEDs, their properties and modulation, Semi-conductor lasers (p-n junction diode, MQW and DFB lasers) and their modulation, Semiconductor Amplifiers.

UNIT IV (12 Hrs.)

Photo-chemical effects, CDROMS, Magneto Optic memories, Persistent spectral hole burning and data storage. Photo detectors – thermal and quantum devices, Noise in light detectors. Coherent and squeezed

states of light, Quantum no demolition measurement, correlated photons, Entanglement and applications to quantum information processing, Coherent control of physical processes.

Recommended Books

1. T.P. Pearsall, 'Photonics Essentials: An Introduction with Experiments', McGraw Hill.
2. F.G. Smit and T.A. King, 'Optics and Photonics: An introduction', John Wiley & Sons.
3. B. Balkrishna Laud, 'Lasers and Non-Linear Optics', Halsted Press.
4. F.A. Jenkins and H.E. White, 'Fundamentals of Optics', McGraw Hill.
5. R.S. Quimby, 'Photonics and Lasers-An Introduction', Wiley-Interscience.
6. E.A. Baha, Saleh and M.C. Teich, 'Fundamental of Photonics', John Wiley and Sons.

DATA ACQUISITION AND PROCESSING

Subject Code: BECE3-875 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives

1. To impart knowledge about the measuring instruments and the methods of measurement
2. To understand different ADCs and DACs.
3. To study and practice calibration and testing of different instrumentation systems.

Course Outcomes

At the end of the course the student shall be able to:

1. Do error budget analysis associated with DACS and ADCS.
2. Analyse and use the functions of various instrumentation systems.

UNIT-I (12 Hrs.)

Introduction: Objective of a DAS, single channel DAS, Multi-channel DAS, Components used in DAS– Converter Characteristics-Resolution-Non-linearity, settling time, Monotonicity.
Digital to analog converters (DACS): Principles and design of – Parallel R– 2R, weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

UNIT-II (12 Hrs.)

Analog to Digital Converters (ADCS): Classification of A/D converters. Parallel feedback – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.
non-linear data converters (NDC): Basic NDC configurations – Some common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM – High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

UNIT-III (12 Hrs.)

Data Converter Applications: DAC applications – Digitally programmable V/I source – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.
ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems – PCM voice communication systems – Test and measurement instruments – Electronic weighing machines.

UNIT-IV (12 Hrs.)

Monolithic Data Converters: Typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a microprocessor.
Error budget of DACS and ADCS: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

Recommended Books

1. Dinesh K. Anvekar, B.S. Sonde, 'Electronic Data Converters Fundamentals and Applications', Tata McGraw Hill.
2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill.
3. Hermann Schmid, 'Electronic Analog/ Digital Conversions', Tata McGraw Hill.
4. E.R. Hanateck, 'User's Handbook of D/A and A'.

VIRTUAL INSTRUMENTATION LAB.

Subject Code: BECE3-834 **L T P C**
0 0 2 1

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

Course Outcomes:
1. To familiarize with the VI software and learn programming in VI.
2. To experiment various functions available in LabVIEW.
3. To practice various Instrument Interfacing and data acquisition methods.
4. To check various analysis tools and develop programs for Process control applications.

EXPERIMENTS

1. Verification of Arithmetic Operations.
2. Verification of Half Adder and Full adder.
3. Program to find Addition of First n natural numbers using for and while loop.
4. Implementation of Array functions.
5. Program for implementing seven segment displays.
6. Program to perform Traffic light control.
7. Calculation of BMI using cluster.
8. Program to control Temperature by using RTD and DAQ.
9. Program to control Temperature by using Thermocouple and DAQ
10. Program to control Temperature by using Thermistor and DAQ
11. Program for controlling the Flow of water using DAQ.
12. Program for controlling the Level of water using DAQ.
13. Program for Pressure control using DAQ.
14. Program for controlling the speed of a DC motor using PID tool box.

Note: At least 10 experiments are required to be performed.

MAJOR PROJECT

Subject Code: BECE3-835 **L T P C**
0 0 12 6

The students are required to undergo Major Project work and it will be evaluated by the external examiner and one internal examiner appointed by the institute/university. External examiner will be from panel of examiners. Assessment of project will be based on Quality of work, Seminar, viva-voice,

report writing. Students can use different hardware and software in order to analyse and verify the results.