JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING
III YEAR COURSE STRUCTURE AND SYLLABUS (R16)

Applicable From 2016-17 Admitted Batch

III YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	EI501PC	Industrial Instrumentation	4	0	0	4
2	EC502PC	Linear and Digital IC Applications	4	0	0	4
3	EI503PC	Microprocessors and Microcontrollers	4	0	0	4
4	SM504MS	Fundamentals of Management	3	0	0	3
5		Open Elective – I	3	0	0	3
6	EI505PC	Industrial Instrumentation Lab	0	0	3	2
7	EI506PC	Linear and Digital IC Applications Lab	0	0	3	2
8	EI507PC	Microprocessors and Microcontrollers Lab	0	0	3	2
9	*MC500HS	Professional Ethics	3	0	0	0
		Total Credits	**21**	**0**	**9**	**24**

III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	EI601PC	Process Dynamics and Control	4	0	0	4
2	EI602PC	Analytical Instrumentation	4	0	0	4
3	EC603PC	Digital Signal Processing	4	0	0	4
4		Open Elective-II	3	0	0	3
5		Professional Elective-I	3	0	0	3
6	EI604PC	Process Control Lab	0	0	3	2
7	EI605PC	Analytical Instrumentation Lab	0	0	3	2
8	EN606HS	Advanced English Communications Skills Laboratory	0	0	3	2
		Total Credits	**18**	**0**	**9**	**24**

During Summer Vacation between III and IV Years: Industry Oriented Mini Project

Professional Elective – I

EI611PE	Principles of Communications
EI612PE	Virtual Instrumentation
EI613PE	Object Oriented Programming through JAVA
EI614PE	Hydraulic And Pneumatic Control Systems

*Open Elective subjects' syllabus is provided in a separate document.

*Open Elective – Students should take Open Electives from the List of Open Electives Offered by Other Departments/Branches Only.

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

INDUSTRIAL INSTRUMENTATION

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: EI501PC   **4   0   0   4**

Course Objectives:
- To impart the knowledge on metrology and different instruments used in industry for length, area, angle roughness/smoothness measurements
- To make the students able to analyze velocity, force and torque measuring instruments used in industry
- To give the students knowledge about different flow meters, pressure meters, density and level meters used in industry and their principles.

Course Outcomes: Upon successful completion of this course the student will be able to:
- Develop the ability to correctly design an instrument and make necessary adjustments for assigned laboratory tasks.
- Prepare the standards required for the calibration of certain laboratory instruments and industrial instruments used for pressure, flow, level etc.

UNIT – I
Metrology: Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge blocks. Optical Methods for length and distance measurements.
Velocity, Acceleration And Force Measurement: Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods.
Accelerometers-different types, Gyroscopes-applications.
Force Measurement: Force measurement – Different methods –Gyroscopic Force Measurement – Vibrating wire Force transducer.

UNIT – III
Pressure and Flow Measurement: Basics of Pressure measurement – Deadweight Gauges and Manometer types – Force-Balance and Vibrating Cylinder Transducers – High and Low Pressure measurement – McLeod Gage, Knudsen Gage, Momentum Transfer Gages, Thermal Conductivity Gages, Ionization Gazes, Dual Gage Techniques,.
Flow Measurement: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type, vertex shedding type, Hotwire anemometer type, Laser Doppler Velocity meter.

UNIT – IV
Density and Level Measurement: Volume Flow meter plus Density measurements – Strain Gauge load cell method – Buoyancy method - Air pressure balance method – Gamma ray method – Vibrating probe method. Direct Mass Flow meters.
Gauge glass techniques coupled with photoelectric readout system-Float type level indication-Different schemes-Boiler drum level measurement-Differential pressure method-

electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

UNIT – V

Radiation and Humidity Measurement: Radiation fundamentals, Radiation detectors, Radiation Thermometers, Optical Pyrometer, sound-Level Meter, Microphones, Time, Frequency and Phase-angle measurement, Liquid level, Humidity terms-Dry and Wert bulb psychrometers -Hot wire electrode type hygrometer-Dew cell-Electrolysis type Hygrometer-Commercial type dew point meter-Moisture terms-Different methods of moisture measurement-Moisture measurement.

TEXT BOOKS:
1. Measurement Systems – Applications and Design – by Doeblin E.O., 4/e, McGraw Hill International, 1990.
2. Principles of Industrial Instrumentation – Patranabis D. TMH. End edition 1997.

REFERENCE BOOKS:
1. Process Instruments and Control Handbook – by Considine D.M., 4/e, McGraw Hill International, 1993.
2. Mechanical and Industrial Measurements – by Jain R.K., Khanna Publishers, 1986.
3. Instrument Technology, vol. I – by Jones E.B., Butterworths, 1981.

LINEAR AND DIGITAL IC APPLICATIONS

		L	T	P	C
B.Tech. III Year I Sem.					
Course Code: EC502PC		**4**	**0**	**0**	**4**

Pre-requisites: Digital Logic and Pulse Circuits

Course Objectives: The main objectives of the course are:
- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non - linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits

Course Outcomes: On completion of this course, the students will have:
- A thorough understanding of operational amplifiers with linear integrated circuits.
- Understanding of the different families of digital integrated circuits and their characteristics.
- Also students will be able to design circuits using operational amplifiers for various applications.

UNIT - I
Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II
Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT - III
Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate, IC interfacing- TTL Driving CMOS & CMOS Driving TTL, Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers , Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic ICs and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers**.**
Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:
1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Operational Amplifiers - George Clayton and Steve Winder, 5th Ed, Elsevier

REFERENCE BOOKS:
1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Modern Digital Electronics – RP Jain – 4/e – TMH, 2010.
3. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005
4. Digital Design Principles and Practices – John. F. Wakerly 3/e, 2005.
5. Operational Amplifiers with Linear Integrated Circuits, 4/e William D. Stanley, Pearson Education India, 2009.

MICROPROCESSORS AND MICROCONTROLLERS

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: EI503PC   **4   0   0   4**

Pre-requisites: Nil.

Course Objectives:
- To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

Course Outcomes:
- Understands the internal architecture and organization of 8086, 8051 and ARM processors/controllers.
- Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.

UNIT - I
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT - II
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.
8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT – III
I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.
Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT – IV
ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions,

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Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V
Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:
1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.
3. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:
1. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
2. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.

FUNDAMENTALS OF MANAGEMENT

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: SM504MS   **3   0   0   3**

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation, and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT - I
Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT - II
Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT - III
Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.
Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT - IV
Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V
Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non - Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.

TEXT BOOKS:
1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:
1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.

INDUSTRIAL INSTRUMENTATION LAB

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: EI505PC   **0   0   3   2**

Course Outcomes: The student is expected to acquire the knowledge is instruments used in any industry and to learn latest simulation software to help his design.

Minimum of Twelve experiments should be conducted.

1. Linearization of Thermistor
2. Study of Level monitoring Instruments using PLC.
3. Calibration of P to I & I to P converters.
4. RPM indicator using Stroboscope and Tachometer
5. Torque Measurement using Gyroscope.
6. Torque measurement using Torsion bar
7. Measurement of Humidity.
8. Measurement of fluid density and fluid flow
9. Measurement of velocity of liquid using Ultrasonic (Doppler effect) method and also flow measurement.
10. Measurement of Level using Capacitance method/Transducer.
11. Displacement measurement using inductive pickup and capacitive pickup.
12. Measurement of Sound intensity. Measurement of aceleration using piezoelectric crystal.
13. Measurement of Blood Pressure.
14. Measurement of EGG.

LINEAR AND DIGITAL IC APPLICATIONS LAB

		L	T	P	C
B.Tech. III Year I Sem.					
Course Code: EI506PC		**0**	**0**	**3**	**2**

Note:
To perform any twelve experiments (choosing at least five from each part).
Verify the functionality of the IC in the given application.

PART - I
Linear IC Experiments
1. OP AMP Applications – Adder, Subtractor, Comparators.
2. Integrator and Differentiator Circuits using IC 741.
3. Active Filter Applications – LPF, HPF (first order)
4. IC 741 Waveform Generators – Sine, Square wave and Triangular waves.
5. IC 555 Timer – Monostable and Astable Multivibrator Circuits.
6. Schmitt Trigger Circuits – using IC 741
7. IC 565 – PLL Applications.
8. Voltage Regulator using IC 723, Three Terminal Voltage Regulators – 7805, 7809, 7912.

PART - II
Digital IC Applications
1. 3-8 decoder using 74138
2. 4-bit comparator using 7485.
3. 8*1 Multiplexer using 74151 and 2*4 Demultiplexer using 74155.
4. D, JK Flip Flops using 7474, 7483.
5. Decade counter using 7490.
6. UP/DOWN counter using 74163
7. Universal shift registers using 74194/195.
8. RAM (16*4) using 74189 (Read and Write operations).

EQUIPMENT REQUIRED:
1. 20 MHz/ 40 MHz/60 MHz Oscilloscope.
2. 1 MHz Function Generator (Sine, Square, Triangular and TTL).
3. Regulated Power Supply.
4. Multimeter / Volt Meter.

MICROPROCESSORS AND MICROCONTROLLERS LAB

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: EI507PC   **0   0   3   2**

Note: - Minimum of 12 experiments to be conducted.
The following programs/experiments are to be written for assembler and to be executed the same with 8086 and 8051 kits.

List of Experiments:
1. Programs for 16 bit arithmetic operations 8086(using various addressing modes)
2. Programs for sorting an array for 8086.
3. Programs for searching for a number of characters in a string for 8086.
4. Programs for string manipulation for 8086.
5. Programs for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessor kits using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/Counter in 8051.
12. Program and verify interrupt handling in 8051.
13. UART operation in 8051.
14. Communication between 8051 kit and PC
15. Interfacing LCD to 8051
16. Interfacing Matrix/Keyboard to 8051
17. Data transfer from peripheral to memory through DMA controller 8237/8257

PROFESSIONAL ETHICS

B.Tech. III Year I Sem.   **L   T   P   C**
Course Code: MC500HS   **3   0   0   0**

Course Objective: To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT - I
Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT - II
Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT - III
Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.
Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT - IV
Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.
Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT - V

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:
1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES
1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

PROCESS DYNAMICS AND CONTROL

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EI601PC   **4   0   0   4**

Course Objectives: To acquire the knowledge on dynamics of simple processes, control actions, control settings, operation of control elements and control valves.

Course Outcomes: Upon completion of this course the student shall be able to understand the concept how control actions are performed in the industries.

UNIT – I
Process Dynamics: Process variables – Load variables – Dynamics of simple pressure, flow level and temperature process – interacting and non-interacting systems – continuous and batch process – self-regulation – Servo and Regulator operation - problems.

UNIT – II
Control Actions and Controllers: Basic control actions – characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative control modes – PI, PD, PID control modes – Problems.
Types of Controllers: Pneumatic, Hydraulic and Electronic Controllers to realize various control actions.

UNIT – III
 Controller Settings: Evaluation criteria – 1/4th decay ratio, IEA, ISE, ITAE - determination of optimum settings for mathematically described process using time response and frequency response.
Tuning of Controllers: Tuning process curve reaction method – continuous oscillation method – damped oscillation method – problems

UNIT – IV
Final Control Elements: I/P Converter, P/I converter - pneumatic, electric and hydraulic actuators – valve Positioner
Control Valves: Control valves – characteristic of control valves – valve body – Globe, Butterfly, diaphragm, Ball valves – Control valve sizing – Cavitations, flashing - problems.

UNIT –V
Multiloop Control System: Feed forward control – Ratio control – Cascade control – Split range – Multivariable control and examples from distillation column and Boiler system.

TEXT BOOKS:
1. Chemical Process Control: An introduction to Theory and Practice – by Stephanopoulos, Prentice Hall, New Delhi, 1999.

2. Process Dynamic Control- Dale E. Seborg, Thomas F. Edgar, and Duncan A. Mellichamp, 2/3 Ed, JW

REFERENCE BOOKS:
1. Process Control, Third Edition – Liptak B.G., Chilton Book Company, Pennsylvania, 1995.
2. Process control – by Pollard A., Heinemann Educational Books, London, 1971.
3. Automatic Process Control – by Eckman D.P. , Wiley Eastern Ltd., New Delhi, 1993.
4. Process Control – Harriott P. , TMH, 1991.

ANALYTICAL INSTRUMENTATION

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EI602PC   **4   0   0   4**

Course Objectives: To introduce spectroscopic methods, Chemical Instrumental Analysis, Electro-analytical methods to numerous applications ranging across healthcare, environmental, and pharmaceutical industries.

Course Outcomes: The student is expected to acquire the knowledge is instruments used in Pharma and chemical Industries.

UNIT – I
pH and Conductivity & Dissolved Component Analyzer: Conductivity meters – pH meters – Dissolved oxygen, hydrogen analyzers – Sodium analyzer – Silica analyzer and sampling systems.
Gas Analyzers: Thermal conductivity types – CO monitor – NOX analyzer – H 2 S analyzer system and sampling – Industrial analyzer circuits, Theory and problems on Beer – Lamberts Law.

UNIT – II
Chromatography – I: Gas chromatography – Liquid chromatography – their principles and applications.
Chromatography – II: Oxygen analyzer – paramagnetic type – detectors and sampling systems.

UNIT – III
Spectrophotometers – I: UV, VIS Spectrophotometers – Single beam and double beam instruments – Instrumentation associated with the above Spectrophotometers – Sources and detectors – Sources and detectors for IR Spectrophotometers.

UNIT – IV
Spectrophotometers – II: FT IR Spectrometer – Flame emission and atomic absorption Spectrophotometer – Atomic emission Spectrophotometer - sources for Flame Photometers and online calorific value measurements.

UNIT – V
Principle of Nuclear Magnetic Resonance: Instrumentation associated with NMR Spectrophotometer – Introduction to mass spectrophotometers, Principle, and brief discussion on ELECTRON SPIN RESONANCE (ESR.)
Special Analytical Instruments: Nuclear radiation detectors – Ionization chamber – GM Counter – Proportional Counter – Solid state detectors ND PMT.

TEXT BOOKS:
1. Handbook of Analytical Instruments – by Khandpur. TMH.
2. Analytical Instrumentation by Bela G. Liptak, CRC Press -1994.

REFERENCE BOOKS:
1. Instrumental Methods of Analysis – by Willard H.H., Merrit L.L., Dean J.A.and Seattle F.L., CBS Publishing and Distributors, 6/e, 1995.
2. Instrument Technology – by Jones B.E., Butterworth Scientific Publ., London, 1987.
3. Mechanical and Industrial Measurements – by Jain R.K., Khanna Publishing, New Delhi, 2/e, 1992.
4. Principles of Instrumental Analysis – by Skoog D.A. and West D.M., Holt Sounder Publication, Philadelphia, 1985.
5. Instrumental Analysis – by Mann C.K., Vickerks T.J. & Gullick W.H., Harper and Row Publishers, New York, 1974.

DIGITAL SIGNAL PROCESSING

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EC603PC   **4   0   0   4**

Course Objectives: This course is an essential course that provides design techniques for processing all type of signals in various fields. The main objectives are:
- To provide background and fundamental material for the analysis and processing of digital signals.
- To familiarize the relationships between continuous-time and discrete time signals and systems.
- To study fundamentals of time, frequency and Z-plane analysis and to discuss the inter-relationships of these analytic method.
- To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
- The impetus is to introduce a few real-world signal processing applications.
- To acquaint in FFT algorithms, Multi-rate signal processing techniques and finite word length effects.

Course Outcomes: On completion of this subject, the student should be able to:
- Perform time, frequency, and Z -transform analysis on signals and systems.
- Understand the inter-relationship between DFT and various transforms.
- Understand the significance of various filter structures and effects of round off errors.
- Design a digital filter for a given specification.
- Understand the fast computation of DFT and appreciate the FFT processing.
- Understand the tradeoffs between normal and multi rate DSP techniques and finite length word effects.

UNIT - I
Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems
Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

UNIT - II
Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

UNIT - III
IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT - IV
FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT - V
Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Upsampling, Interpolation, Sampling Rate Conversion, Conversion of Band Pass Signals, Concept of Resampling, Applications of Multi Rate Signal Processing.
Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round off Noise, Methods to Prevent Overflow, Trade off between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

TEXT BOOKS:
1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
3. Fundamentals of Digital Signal Processing – Loney Ludeman, John Wiley, 2009

REFERENCES:
1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd Edition, Pearson Education, 2009.

PRINCIPLES OF COMMUNICATIONS
(Professional Elective – I)

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EI611PE   **3   0   0   3**

Pre-requisites: Nil

Course Objective: To provide the basic concepts of communication systems.

Course Outcomes: On successful completion of the module students will be able to…
- explain the main concepts of analogue and digital communication systems;
- analyze and design an AM and FM modulator/demodulator;
- explain, discuss, and compare different binary digital modulation techniques;
- explain types of noise & effects of noise on communication system

UNIT - I
Introduction:
Block diagram of Electrical communication system, Radio communication : Types of communications, Analog, pulse and digital Types of signals, Noise – Types of noise, sources of noise, calculation of noise in Linear systems, and noise figure.

UNIT - II
Amplitude Modulation: Need for modulation, Types of Amplitude modulation, AM, DSB SC, SSB SC, Power and BW requirements, generation of AM, DSB SC, SSB SC, Demodulation of AM: Diode detector, Product demodulation for DSB SC & SSB SC.
Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

UNIT - III
Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

UNIT - IV
Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison.
Digital Modulation: ASK, FSK, PSK, DPSK, QPSK demodulation, coherent and incoherent reception, Modems.

UNIT - V
Information Theory: Concept of information, rate of information and entropy, Source coding for optimum rate of information, Coding efficiency, Shanon-Fano and Huffman coding.

Error control coding: Introduction, Error detection and correction codes, block codes, convolution codes.

TEXT BOOKS:
1. Communication Systems Analog and Digital – R.P. Singh and SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

REFERENCE BOOKS:
1. Electronic Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
2. Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2nd Ed. 2004.

VIRTUAL INSTRUMENTATION
(Professional Elective – I)

B.Tech. III Year II Sem.	L	T	P	C
Course Code: EI612PE	3	0	0	3

Course Objectives: To introduce LabVIEW programming and simulation of real time applications like instrument control, Signal processing, image processing, Data acquisition etc.,

Course Outcomes: Upon completion of this course the student shall be able to develop their own GSD and interface them with real world instruments.

UNIT - I
Virtual Instrumentation: An introduction Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems.

UNIT - II
VI programming techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT - III
Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques, and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT - IV
VI Interface requirements: Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT - V
VI toolsets: Distributed I/O modules. Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

TEXTBOOKS:
1. LabVIEW Graphical Programming, Gary Johnson, Second edition, McGraw Hill, Newyork, 1997.
2. LabVIEW based Advanced Instrumentation Systems, S. Sumathi and P. Surekha, Spinger.

REFERENCE BOOKS:
1. PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Kevin James, Newnes, 2000.
2. WEB RESOURCES: www.ni.com
3. LabVIEW for everyone, Lisa K. wells & Jeffrey Travis Prentice Hall, New Jersey, 1997.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA
(Professional Elective – I)

B.Tech. III Year II Sem.	**L**	**T**	**P**	**C**
Course Code: EI613PE	**3**	**0**	**0**	**3**

Course Objectives:
- To introduce the object oriented programming concepts.
- To understand object oriented programming concepts, and apply them in solving problems.
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce the concepts of exception handling and multithreading.
- To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes:
- Able to solve real world problems using OOP techniques.
- Able to understand the use of abstract classes.
- Able to solve problems using java collection framework and I/o classes.
- Able to develop multithreaded applications with synchronization.
- Able to develop applets for web applications.
- Able to design GUI based applications

UNIT - I
Object-oriented thinking- A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling.
Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

UNIT - II
Packages- Defining a Package, CLASSPATH, Access protection, importing packages.
Interfaces- defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces.
Stream based I/O(java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

UNIT - III

Exception handling - Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT - IV

The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable ,Properties, Stack, Vector

More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

UNIT - V

GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.

Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

 A Simple Swing Application, **Applets** – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, Painting in Swing, A Paint example, Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

TEXT BOOKS
1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

REFERENCE BOOKS
1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
4. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
5. Java Programming and Object oriented Application Development, R. A. Johnson, Cengage Learning.

HYDRAULICS AND PNEUMATIC CONTROL SYSTEMS
(Professional Elective – I)

B.Tech. III Year II Sem.	**L**	**T**	**P**	**C**
Course Code: EI614PE	**3**	**0**	**0**	**3**

Course Objective: To study hydraulic and pneumatic control systems

Course Outcomes: Upon completion of this subject the students shall give the solution to problem relating to system identification.

UNIT – I

Introduction to Fluid Power, merits and utility of Fluid Power in industries. Difference between Hydraulic Systems & Pneumatic Systems. Fluid Power Components: Construction and operation of – Pump, Relief valve, Non-return valve, Pilot operated relief valve, Series and Parallel compensator of flow valve, Pressure compensated pump, motor, actuators, Seals used in the control systems.

Symbolic representation of Hydraulic and pneumatic Elements. Compressor and air line installations. Various types of Pumps used in hydraulic systems. Hydraulic Fluid and Effective contamination control. Purpose of Air-filters and types in Pneumatic systems.

UNIT – II

Transmission System: Transmission of Fluid Power through various type of cylinders. Compressibility and inertia loading. Hydraulic stiffness, stiffness of pneumatic system. Component effectiveness, breakage, constant torque load, constant power load, inertia load, viscous damping.

Valve controlled Systems: Flow through a single speed control valve, Series Pressure Compensation, combined directional and flow rate control valve, Steady reaction and Transient Reaction force.

UNIT – III

Hydraulic and pneumatic circuits for different controls like – Sequencing circuit, counter balancing, indexing, linear motion, rotation & Hydro copying circuit. Electro-Pneumatics & Electro-Hydraulic controls, Hydro-Pneumatics, Cartridge valve design.

Analysis of Accumulator Systems: Accumulator system dynamics, Thermodynamics, Thermodynamics consideration. Accumulator as Absorber of pressure shocks. Construction, operation, and applications of Intensifier.

UNIT – IV

Feedback Systems: Pressure control, Position control, Pump/motor systems. Control with variable capacity pumps. Pump stroke mechanisms. Position control using metering valve Double acting actuators.

UNIT – V

Speed control, Inertia Load position control systems. Programmable sequential control using modular elements. Servo control systems. Trouble shooting and remedial measures in Hydraulic & Pneumatic Systems.

TEXT BOOKS:
1. Fluid Power Systems, by A.B. Goodinain, McMillan Press Ltd.
2. The Control of Fluid Power, by McCloy & Martin, Longman Publications.

REFERENCE BOOKS:
1. Mechatronics, by Prof. C.V. Venkataramana, SBS Publishers and Distributors.
2. Production Drawing Practice, by Dr. P. Narsimha Reddy, T. A. Janardhan Reddy & C. Srinivas Rao, The Hi-Tech Publishers.

PROCESS CONTROL LAB

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EI604PC   **0   0   3   2**

Course Objective: To provide better familiarity with the Theoretical concepts studied.

Course Outcomes: Upon completing these course students shall be able realize the process and different controls applied to each process.

Minimum Twelve experiments should be conducted.

1. Study of Electronic controllers.
2. Control valve characteristics (Different types).
3. Control of Flow process
4. Interacting and Non- interacting systems.
5. Control of Temperature process
6. Process tuning – Process reaction curve method.
7. Tuning of PID controller
8. Operation of flow loop in plant.
9. Pneumatic actuator.
10. Hydraulic actuator.
11. Multi loop control systems – Ratio Control.
12. Multi loop control systems – Cascade Control.
13. Feed-forward control.

ANALYTICAL INSTRUMENTATION LAB

B.Tech. III Year II Sem.   **L T P C**
Course Code: EI605PC   **0 0 3 2**

To perform All experiments.

1. Gas analyzers.
2. Gas and liquid chromatography.
3. Spectrometer: UV and VIS spectrometer.
4. Spectrometer: IR and FT IR Spectrometer.
5. Flame photometer.
6. Measurement of calorific value using Bomb Calorimeter
7. pH Meter
8. Conductivity Meter
9. GM Counter
10. Measurement of Gas Pollutants - Co, No, So
11. Water Purity Measurement
12. Turbidity Measurement

Equipment:

Gas/ Liquid chromatographer, Gas Analyzer, UV & VIS spectrometer, IR spectrophotometer, Absorption spectrophotometer, Flame photometer, Bomb calorimeter.

ADVANCED ENGLISH COMMUNICATION SKILLS (AECS) LAB

B.Tech. III Year II Sem.   **L   T   P   C**
Course Code: EN606HS   **0   0   3   2**

Introduction
A course on *Advanced English Communication Skills (AECS) Lab* is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

Course Objectives: This Lab focuses on using multi-media instruction for language development to meet the following targets:
- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioral skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

Course Outcomes: Students will be able to:
- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

Syllabus
The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. **Inter-personal Communication and Building Vocabulary** - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.
2. **Reading Comprehension** –General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, Skimming, Scanning, Inferring Meaning.
3. **Writing Skills** – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.
4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments… etc.,
5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process,

Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

Minimum Hardware Requirement
Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics**
- **Eight round tables with five movable chairs for each table.**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **Computer with suitable configuration**

Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 8th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**

REFERENCES:
1. Kumar, Sanjay, and Pushp Lata. ***English for Effective Communication***, Oxford University Press, 2015.
2. Konar, Nira. English Language Laboratories – A Comprehensive Manual, PHI Learning Pvt. Ltd., 2011.