CURRICULUM STRUCTURE OF S. Y. B. TECH (Instrumentation & Control)

Effective from Academic Year 2012-2013

Semester: I

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/MA 201	Engineering Mathematics-III	3	1	-	4
02	PCC/IE 201	Transducers I	3	-	-	3
03	PCC/ IE 202	Analog Techniques	3	-	-	3
04	PCC/ IE 203	Electrical Measurement and Instrumentation	3	-	-	3
05	LC/ IE 204	Transducers I Laboratory	-	-	3	2
06	LC/IE 205	Analog Techniques Laboratory	-	-	3	2
07	LC/IE 206	Electrical Measurement and Instrumentation Laboratory	-	-	3	2
08	HSSC/AS 207	Professional Communication	2	-	-	2
09	MLC/	Environmental Studies	2	-	-	2
		Total	**16**	**1**	**9**	**23**

Semester: II

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/AS 204	Applied Biology	3	-	-	3
02	PCC/IE 211	Transducers II	3	-	-	3
03	PCC/IE 212	Automatic Control Systems	3	-	-	3
04	PCC/IE 213	Digital Techniques	3	-	-	3
05	LC/IE 214	Transducers II Laboratory	-	-	3	2
06	LC/IE 215	Automatic Control Systems Laboratory	-	-	3	2
07	LC/IE 216	Digital Techniques Laboratory	-	-	3	2
08	LC/IE 217	Computational Techniques Laboratory	-	-	3	2
09	PSC/IE 218*	Refer to the Annexure-I	3	-	-	3
10	LLC	Refer to the Annexure-II	1	-	-	1
		Total	**16**	**0**	**12**	**24**

CURRICULUM STRUCTURE OF S. Y. B.TECH (Instrumentation & Control)
For Direct Second Year Diploma Students

Effective from Academic Year 2012-2013

Semester: I

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC	Foundation of Mathematics I	3	1	-	4
02	BSC	Foundation of Physics	3	0	0	3
03	PCC/IE 201	Transducers I	3	-	-	3
04	PCC/ IE 202	Analog Techniques	3	-	-	3
05	PCC/ IE 203	Electrical Measurement and Instrumentation	3	-	-	3
06	LC/ IE 204	Transducers I Laboratory	-	-	3	2
07	LC/IE 205	Analog Techniques Laboratory	-	-	3	2
08	LC/IE 206	Electrical Measurement and Instrumentation Laboratory	-	-	3	2
09	HSSC/AS 207	Professional Communication	2	-	-	2
10	MLC/	Environmental Studies	2	-	-	2
		Total	**19**	**1**	**9**	**26**

Semester: II

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC	Foundation Mathematics II	3	1	-	4
02	BSC/AS 204	Applied Biology	3	-	-	3
03	PCC/IE 211	Transducers II	3	-	-	3
04	PCC/IE 212	Automatic Control Systems	3	-	-	3
05	PCC/IE 213	Digital Techniques	3	-	-	3
06	LC/IE 214	Transducers II Laboratory	-	-	3	2
07	LC/IE 215	Automatic Control Systems Laboratory	-	-	3	2
08	LC/IE 216	Digital Techniques Laboratory	-	-	3	2
09	LC/IE 217	Computational Techniques Laboratory	-	-	3	2
10	PSC/IE 218*	Refer to the Annexure-I	3	-	-	3
11	LLC	Refer to the Annexure-II	1	-	-	1
		Total	**19**	**01**	**12**	**28**

CURRICULUM STRUCTURE OF T. Y. B.TECH (Instrumentation & Control)

Effective from Academic Year 2013-2014

Semester I

Sr. No	Subject Title	Category of Course	Contact hours L	T	P	Credits
01	Microcontroller Techniques and its Applications	PCC	3	-	-	3
02	Process Plant Operations	PCC	3	-	-	3
03	Signals and Systems	PCC	3	-	-	3
04	Control System Design	PCC	3	-	-	3
05	Control System Components	PCC	2	-	-	2
06	Numerical Methods Laboratory	LC	-	-	3	2
07	Microcontroller Techniques and its Applications Laboratory	LC	-	-	3	2
08	Control System Components Laboratory	LC	-	-	3	2
09	Control System Design Laboratory	LC	-	-	3	2
10	Humanities Course	HSSC	2	-	-	2
		Total	**16**		**12**	**24**

Semester: II

Sr. No	Subject Title	Category of Course	Contact hours L	T	P	Credits
01	Open Elective / Science Elective	OEC/SEC	3	-	-	3
02	Process Loop Components	PCC	3	-	-	3
03	Digital Signal Processing	PCC	3	-	-	3
04	Instrument and System Design	PCC	3	-	-	3
05	Analytical Instrumentation	PCC	3	-	-	3
06	Process Loop Components Laboratory	LC	-	-	3	2
07	Digital Signal Processing Laboratory	LC	-	-	3	2
08	Instrument and System Design Laboratory	LC	-	-	2	1
09	Analytical Instrumentation Laboratory	LC	-	-	2	1
10	Liberal Learning Course	LLC	1	-	-	1
11	Constitution of India	MLC	2	-	-	2
	Total		**18**	**-**	**10**	**24**

CURRICULUM STRUCTURE OF Final Year B. TECH (Instrumentation & Control)

Effective from Academic Year 2014-2015

Semester: I

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	OEC/BSC/HSSC	Open Elective /Science Elective Course/Humanities Elective	3	-	-	3
02	PCC/	Process Instrumentation	3	-	-	3
03	PCC/	Project Engineering and Management	1	-	3	3
04	DEC/	Departmental Elective-I	3	-	-	3
05	DEC/	Departmental Elective II	3	-	-	3
06	LC/	Process Instrumentation Laboratory	-	-	3	2
07	LC/	Industrial Automation Laboratory	-	-	3	2
08	PCC/	Project Stage I	-	-	-	2
09	PCC/	Seminar	-	-	-	1
10	LLC/	Liberal Learning Course	1	-	-	1
		Total	**14**	**-**	**9**	**23**

Semester: II

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	OEC/BSC/HSSC/DE	Open Elective/Science Elective/Humanities Course/Department Elective	3	-	-	3
02	DEC/	Departmental Elective-III	3	-	-	3
03	DEC/	Departmental Elective-IV	3	-	-	3
04	PCC/	Project Stage II	-	-	-	10
05	MLC/	Intellectual Property Rights	1	-	-	1
		Total	**10**	**0**	**0**	**20**

MICROCONTROLLER TECHNIQUES AND ITS APPLICATIONS

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	Mid-Sem – 30 Test/Quiz -20 End-Sem Exam- 50

Objectives:

- Understand the basic difference between general-purpose processors and task specific processors as microcontrollers.
- Students will gain an understanding of programming at the assembly code level as a foundation for their understanding of higher-level languages. The use of high-level language in embedded systems will be examined.
- Students will gain practical experience with interfacing between a microcontroller and external world including the use of simple transducers (eg. A to D and D to A)
- Build small microcontroller based projects involving real-time signals.

Unit 1 **(08)**

Microcontroller Basics: Difference between microprocessor and microcontroller, architectural considerations, CPU, memory sub system, I/O sub system, control logic. Architecture of MCS-51 microcontroller. Memory structure, different registers (SFR's), addressing modes. Timing Diagram, timing diagram for execution cycle.

Unit 2 **(08)**

Programming: Concept of assembler directives, editor, linker, loader, debugger, simulator, emulator. Instruction set, basic programming using 8051 instructions. Introduction to embedded-C, Integrated Development Environment (IDE), cross compiler, ISP, software delay generation.

Unit 3 **(06)**

I/O Programming: I/O programming, interfacing with simple switch, LED. Seven segment interfacing techniques. Programming with alphanumeric LCD and matrix keypad.

Unit 4 **(08)**

On-Chip Peripheral Interfaces: Programming with on-chip Timers, Counters, UART, RS485 transceiver. I2C and SPI protocols. Interrupts, interrupt execution sequence, programming with software and hardware interrupts.

Unit 5 **(06)**

External Interfaces: Analog to digital convertor, interfacing with external serial and parallel ADC's, Digital to analog convertor (DAC), interfacing with DAC, Interfacing with stepper motor and DC motor.

Unit 6 **(06)**

RISC Microcontrollers, introduction to AVR series microcontrollers. Introduction to ARM7 microcontroller (LPC2148).

Course Outcomes:

i. Understanding of the basic principles of Microcontroller based design and development. [PEO2][PO-m]
ii. Ability to design and build a functional prototype for real world applications. [PEO2][PO-c]
iii. To encourage the students to have a better understanding on state-of-the-art interfacing technologies, their potential applications and their market views. [PEO2][PO-m]
iv. Ability to undertake problem identification, formulation and selection of appropriate Microcontrollers. [PEO1][PO-e]
v. To test whether students can apply their knowledge of fundamentals of Microcontrollers, programming and interfacing technology to solve and design simple engineering problems. [PEO1][PO-a]

Text Books:

1. Mohammad Ali Mazidi, "The 8051 Microcontroller and Embedded System: Using Assembly and C", Pearson education, Second ed., 2006.
2. Kenneth J. Ayala, "8051 Microcontroller: Programming, Architecture and Interfacing", Thomas Delmar Learning, Third ed., 2007.

Reference Books:

1. INTEL Manual: MCS-51 Architecture.
2. Philips Data Handbook, "I2C Peripherals".
3. IEEE Standards, "Low Rate Wireless Personal Area Networks", 2003.
4. Jan Axelson, "USB Complete", Penram International Publishing House, First ed., 1998.

PROCESS PLANT OPERATIONS

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- To learn the basics of unit operations and equipment
- Be able to apply the physical properties and its effects on unit operations
- Apply theory to current industrial environment

Unit 1 **(06)**

Introduction: Different physical and chemical laws. Basic concepts and principles of commonly used unit operation with processes, study related to different process industries with some examples of Distillations, extraction, humidification. Basic concepts of corrosion and protection from corrosion. Selection materials, metals & alloys used in construction of field instruments for different applications

Unit 2 **(06)**

Fluid transportation operations and equipments: Basic concepts of fluid transportation operations, different means of fluid transportation. Basic concepts, specifications and working of pumps, compressors, fans, blowers. Selection of equipments and its material for different applications

Unit 3 **(08)**

Heat transfer Operations: Concepts of Energy balance, heat transfer coefficients. Basic principles, working and selection criteria for double pipe, shell & tube heat exchangers, boilers, condensers, evaporators, cooling towers. Role of kinetics, types of reactors, types of reaction/reactors, biochemical reactions commonly encountered in chemical process industries, Role of thermodynamics

Unit 4 **(08)**

Mass transfer Operations: Material balance with or without chemical reactions mass transfer coefficients. Principles , working , process & mechanical design considerations for equipments used for unit operations like distillation, extraction, drying, humidification, dehumidification, absorption, filtration, sedimentation

Unit 5 **(06)**

Size reduction and mechanical separation operations: Crushing and grinding, size separation and screening. Selection criteria and considerations for equipment used for size reduction and mechanical separation. Laws of commutation forced and hindered setting. Working of forth floatation, hydro cyclones, jigging and concentration equipment.

Unit 6 **(08)**

Unit operations in different industries: Identification and justification of unit operations used in different industries like food, pharma, paper, sugar, cement, fertilizer, Petrochemical industry with help of process flow diagram

Course Outcomes:

i. Knowledge of unit operations and effect of other parameters on them. [PEO-1] [PO-b]
ii. Instrumentation and control related with the unit operations [PEO-2] [PO-f]
iii. Identification of unit operations in different industries [PEO-2] [PO-j]

Text Books:

1. Warren L. McCabe, Julian C. Smith, Peter Harroitt "Unit Operation in Chemical Engineering" McGraw Hill. Fifth ed., 2005.

Reference Books:

1. Bela G Liptak, "Instrument Engineers Handbook: Process Control" Pearson Education, Third ed., 1985.

SIGNALS AND SYSTEMS

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- To study the properties and representation of discrete and continuous signals
- To study sampling process and analysis of discrete systems using z-transforms
- To study the analysis and synthesis of discrete time system

Unit 1 **(08)**

Introduction to Signals and Systems: Introduction to Signals, Classification of Signals, Continuous Time and Discrete Time Signals, Step and Impulse Functions, Transformation of Independent Variable. Introduction to Systems, Classification of Systems, Properties of Systems, Normal Form of System Equation, Initial Conditions, Impulse Response of a Physical System, Introduction to Convolution, System Impulse Response

Unit 2 **(06)**

Analysis of Systems: System characteristics, Convolution Sum, Sampling theorem, reconstruction, aliasing, sampling in the frequency domain, sampling of discrete time signals, decimation and interpolation

Unit 3 **(06)**

Z-Transform: Definition, properties of z-transform, z-transform of standard sequences, inverse Z-transform, relationship of z-transform with fourier transform, applications of Z-transform to solutions of difference equations, Properties and applications of Z transform

Unit 4 **(06)**

Fourier Transform Analysis: Fourier analysis for Continuous time signals and systems, Continuous time Fourier series and its convergence, Continuous time Fourier Transform, its properties, frequency response

Unit 5 **(08)**

Frequency Response Characteristics of LTI system Frequency response of a system to complex exponential and sinusoidal signals, steady state and transient response to sinusoidal inputs signals, computation of frequency response functions. Design of LTI systems as frequency selective filters. Finite Impulse Response, Infinite Impulse response filter structures for FIR filters: direct, cascade, frequency sampling and lattice. Structure of IIR filters: direct, cascade, parallel, lattice. Effect of finite word length in Digital filters

Unit 6 **(08)**

Discrete Fourier Transform: Discrete time Fourier series and its convergence, Discrete time Fourier Transform, its properties, frequency response. Introduction to DFT in time domain and frequency domain. Filtering: Ideal frequency selective filters, Non Ideal frequency selective filters, examples, Butterworth filters

Course Outcomes:

i. Ability to discuss properties & representation of discrete and continuous signals.[PEO-1] [PO-c]
ii. Ability to distinguish sample process & analyze discrete system using z transform[PEO-1] [PO-a]
iii. Ability to hypothesis discrete time system [PEO1] [PO-b]

Text Books:

1. Michael J. Robert, "Introduction to Signals and Systems", TMH, Second ed., 2003.
2. Murray R Spiegel, John Schiller and R Alu Srinivasn, "Probability and Statistics", Scaum's Outline TMH, Fourth ed., 2010.

Reference Books:

1. Alan V Oppenhein, Alan S Wiilsky, "Signals and systems" PHI, Second ed. 2009.

CONTROL SYSTEM DESIGN

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- Study of modern control theory
- Understand basic principles of various controller design approaches
- Understand uncertainty and disturbance effect on system

Unit 1 **(07)**

State space: General state space representation, converting state space to transfer function and vice versa controller design introduction, design with state feedback, controller design by Ackerman's formula

Unit 2 **(08)**

Controller and observer design: Pole placement, solving pole placement with MATLAB, Controllability, different approaches for controller design, Introduction to observer , full order and reduced order observer, observability, different approaches for observability design

Unit 3 **(07)**

Design of controller with root locus: transient response via gain adjustment, improving time domain specifications (steady state error, transient response) by cascade compensation, feedback compensation

Unit 4 **(08)**

Controller design: Design of Proportional (P), Integral (I), Derivative (D), PI, PD, PID controllers, lead, lag, lead-lag controller by root locus method

Unit 5 **(06)**

Design of controller in frequency domain: Design of controller with bode plot: improvement of steady state and transient response with lead, lag, lead lag compensator design

Unit 6 **(06)**

System uncertainties and disturbances: Effect of uncertainties and disturbances on system performance, uncertainty and disturbance estimation, Effect of uncertainties and disturbances on controller and observer design, effect of measurement noise and un-modeled dynamics.

Course Outcomes:

i. An ability to design output feedback controller in state space. [PEO1] [PO-l]
ii. Ability to design full state observer. [PEO1] [PO-e]
iii. Ability to design lead, lag, lead-lag compensators. [PEO1] [PO-l]
iv. Ability to model hydraulic, pneumatic, thermal systems. [PEO1] [PO-e]

Text Books:

1. Norman Nise, "Control System Engineering", Wiley India, Fifth ed., 2009.
2. K. Ogata," Modern Control Engineering", PHI, Fifth ed., 2009.

Reference Books:

1. G. C. Goodwin, S. F. Graebe, M. E. Salgado; "Control System Design", PHI, First ed. 2002.
2. Friedland, "Control System Design", Dover Publication, First ed., 2005.

CONTROL SYSTEM COMPONENTS

Teaching Scheme	**Examination Scheme**
Lectures : 2 hrs/week	Mid-Sem – 30 Assignments, Quiz -20 End-Sem Exam- 50

Objectives:

- To study types/working principle and application of various motor.
- To learn pneumatic components and systems
- To study hydraulic components and systems.

Unit 1 **(06)**

Motors: Types, working principle, characteristic, and mathematical model of following: Motors AC/DC motors, stepper, servo, linear, Synchronous, Generators, and Alternator

Unit 2 **(06)**

Types, working principle, characteristics, and symbolic representation of following:
Switches: Toggle, Slide, DIP, Rotary, Thumbwheel, Selector, Limit, Proximity, Combinational switches, zero speed, belt sway, pull cord.
Relays: Electromechanical, Solid state relays, relay packages
Contactors :Comparison between relay & contactor, contactor size and ratings
Timers : On Delay, Off delay and Retentive

Unit 3 **(08)**

Sequencing & Interlocking for motors: Concept of sequencing & Interlocking, Standard symbols used for Electrical Wiring Diagram, Electrical Wiring diagrams for Starting, Stopping, Emergency shutdown, (Direct on line, star delta, soft starter) Protection devices for motors: Short circuit protection, Over load Protection, Over/ under voltage protection, Phase reversal Protection, high temperature and high current Protection, over speed, Reversing direction of rotation, Braking, Starting with variable speeds, Jogging/Inching
Motor Control Center: Concept and wiring diagrams

Unit 4 **(08)**

Pneumatic components: Pneumatic Power Supply and its components: Pneumatic relay (Bleed & Non bleed, Reverse & direct), Single acting & Double acting cylinder, Special cylinders: Cushion, Double rod, Tandem, Multiple position, Rotary Filter Regulator Lubricator (FRL), Pneumatic valves (direction controlled valves, flow control etc), Special types of valves like relief valve, pressure reducing etc.
Hydraulic components:
Hydraulic supply, Hydraulic pumps, Actuator (cylinder & motor), Hydraulic valves

Course Outcomes:

i. Ability to select and use the components for electrical systems [PEO1][PO-c]
ii. Ability to identify, formulate and solve a problem using pneumatic system in instrumentation and control engineering. [PEO1][PO-e]
iii. Ability to identify, formulate and solve a problem using hydraulic system in instrumentation and control engineering. [PEO1][PO-e]

Text Books:

1. B. L. Theraja, "A text book of Electrical Technology", S. Chand & Company Ltd., Vol II First ed. 1959
2. Petruzella, "Industrial Electronics", McGraw-Hill International First ed., 1996
3. S. R. Majumdhar, "Pneumatic Systems", Tata McGraw-Hill Publisher, 2009

Reference Books:

1. Meixner H and Sauer E, "Intro to Electro-Pneumatics", Festo didactic, First ed. 1989.
2. Hasebrink J P and Kobler R, "Fundamentals of Pneumatic Control Engineering", FestoDidactic: Esslinger(W Germany),1989.

NUMERICAL METHODS LABORATORY

Teaching Scheme

Lab: 3hrs/week

Examination Scheme

Continuous Evaluation: 50

Practical Exam- 50

Objectives:

- To study and understand the various numerical methods.
- To study the various methods for determining the error in numerical calculations and polynomial interpolation.
- To understand different methods to solve Algebraic and Transcendental Equations.
- To study and implement different techniques for solving numerical differentiation and integration.
- To understand the various solutions of ordinary differential and integral equations.

List of Experiments

WRITE DOWN AND EXECUTE THE FOLLOWING PROGRAMS USING C/C++/MATLAB

1. Roots of Non-Linear Equations-To find the roots of non-linear equations using Bisection method.
2. Roots of Non-Linear Equations -To find the roots of non-linear equation using Newton-Raphson method.
3. Interpolation- Using Linear or Quadratic interpolation, finds intermediate data point from given set of data.
4. Interpolation- Using Lagrange interpolation, find intermediate data point form given set of data and compare the result with linear or quadratic interpolation
5. Curve Fitting- For a give data set; find best fit curve using linear regression.
6. Curve Fitting- For a give data set; find best fit curve using polynomial regression.
7. Linear Solver-To solve system of linear equations using Gauss Elimination method.
8. Linear Solver-To solve system of linear equations using Gauss Jordan method.
9. Integration-To integrate numerically using Trapezoidal Rule
10. Integration-To integrate numerically using Simpson's Rule
11. Matrix Eigen values-To find Eigen values of matrix by power method
12. Differential Equation-To find numerical solution of ordinary differential equations by Euler's method
13. Differential Equation-To find numerical solution of ordinary differential equations by Runge- Kutta method

Course Outcomes:

i. Be aware of the use of numerical methods in modern scientific computing.[PEO1] [PO-a, b]
ii. Be familiar with finite precision computation.[PEO1] [PO-a, e]
iii. Be familiar with numerical solutions of nonlinear equations in a single variable.[PEO1] [PO-a, e]

iv. Ability to determine different methods numerical interpolation and approximation of functions.[PEO1] [PO-a, e]
v. Be familiar with numerical integration and differentiation.[PEO1] [PO-a, e]
vi. Ability to give the solution of ordinary differential equations through different methods.[PEO1] [PO-a, e]
vii. Be familiar with calculation and interpretation of errors in numerical methods.[PEO1] [PO-a, e]

MICROCONTROLLER TECHNIQUES AND ITS APPLICATIONS LABORATORY

Teaching Scheme	**Examination Scheme**
Lab: 3 hrs/week	Continuous Evaluation: 50 Practical Exam- 50

Objectives:

- Study software development tools such as assembler, IDE- "KEIL" used for MCS-51 series microcontrollers
- Learn low level (Assembly) as well as high level language (Embedded-C) for programming MCS-51 series microcontrollers
- Study various on-chip as well as external interfacing techniques
- Develop skills and ability to select an appropriate microcontrollers and interfacing devices for real life embedded applications

Students have to perform minimum 16 experiments using following embedded platforms:
1. Twelve experiments using8051 microcontrollers (MCS-51 series microcontrollers).
2. Two experiments using Arduino board (AVR series Microcontroller).
3. Two experiment using LPC 2148 board (ARM 7 series microcontroller)

Case study: Course project using above interfacing techniques.

Course Outcomes:

i. Ability to develop, design and debug of low-level and high level language of 8051 based microcontroller with basic interfacing techniques on different interfacing devices. [PEO1][PO-a]
ii. Ability to identify, and select an appropriate microcontroller as well as development tools for given applications [PEO1] [PO-e]
iii. Ability to function effectively as an individual and in teams, with the capacity to be a leader or manager as well as an effective team member [PEO1][PO-k]

CONTROL SYSTEM COMPONENTS LABORATORY

Teaching Scheme

Lab : 3 hrs/week

Examination Scheme

Continuous evaluation- 50

Practical Exam- 50

Objectives:

- To implement electrical circuit for motor.
- To design various pneumatic circuits.
- To design various hydraulic circuits.

1. Study of symbols used in electrical wiring diagram
2. Study of electromagnetic relay and solid state relay
3. Wiring diagram for logic function AND/OR/NOT
4. Wiring diagram for DOL/ Star-delta starter
5. Study of Pneumatic system components
6. Build pneumatic circuit to operate single acting and double acting cylinder.
7. Build pneumatic circuit to operate double acting cylinder using AND and OR function
8. Build of Pneumatic circuit for speed control of a cylinder.
9. Build pneumatic circuit to operate double acting cylinder using time delay function
10. Study of hydraulic system components
11. Build hydraulic circuit to operate double acting cylinder
12. Build hydraulic circuit to operate double acting cylinder using electro hydraulic Components.

Course Outcomes:

i. An ability to characterize performance of motor. [PEO2] [PO-c]
ii. Implementation of electrical circuits for motor operation. [PEO1] [PO-e]
iii. Implementation of pneumatic circuits to solve a problem. [PEO1] [PO-e]
iv. Implementation of hydraulic circuits to solve a problem. [PEO1] [PO-e]

CONTROL SYSTEM DESIGN LABORATORY

Teaching Scheme	**Examination Scheme**
Lab: 3 hrs/week	Continuous evaluation- 50
	Practical Exam- 50

Objectives:

- Design state feedback controller and observer to validate performance
- Implement controller and observer on real time plant.
- Design different controllers validate performance
- Study effect of uncertainties and disturbances on system performance

Students have to perform minimum 12 experiments in MATLAB environment and validate in real time domain.

List of Experiments:

1. Find state transition matrix from a given system dynamic
2. Design an observer for a given system by using state space method.
3. Validation of observer design on QUBE (position and speed control).
4. Design state feedback controller for a given system.
5. Validation of controller design on QUBE (position and speed control)
6. Design controller by adjusting gain for a given system by using root locus method.
7. Validation of controller design on QUBE (position and speed control).
8. Design controller for improving transient and steady state response by root locus method.
9. Design of PID controller.
10. Validation of PID controller design on QUBE (position and speed control).
11. Design of lead controller to satisfy given specifications using bode plot.
12. Design of lag controller to satisfy given specifications using bode plot.
13. Design lag-lead controller to satisfy given specifications using bode plot.
14. Validation of lag-lead controller design on QUBE (position and speed control).
15. Study effect of uncertainty and disturbance on system performance.
16. Design of uncertainty and disturbance method and validate on QUBE.

Course Outcomes:

i. Able to design controllers and observer for general systems to validate performance on real time system. [PEO1] [PO-l]
ii. Able to design and validate the effect of uncertainty and disturbances on controller and observer design [PEO1] [PO-e]
iii. Able to design and PI, PD, PID controllers and evaluate the performance [PEO1] [PO-l]

HUMANITIES COURSE-INTRODUCTION TO PSYCHOLOGY

Teaching Scheme	**Examination Scheme**
Lectures: 2 hrs/week	Mid-Sem – 30 Assignments, Quiz -20 End-Sem Exam- 50

Objectives:

- To understand one's own personality and develop maximum potential.
- To learn and enhance essential skills for personality development.
- To understand importance of emotions in interpersonal relationships.

Unit 1 **(06)**

Introduction to Psychology: Definition, Nature, Aims and Branches of Psychology Individual Differences-Nature and Nurture

Unit 2 **(10)**

Personality: Definition, Nature and Types Indian Perspective on Personality- Panchakosh Model, Personality Assessment- Psychological Tests

Unit 3 **(08)**

Study Skills: Learning Effective strategies for learning, enhancing motivation Memory improvement principles and techniques, Time management Creativity, Positive Attitude

Unit 4 **(06)**

Stress Management: Nature, Definition, Causes of Stress and Types of Stress, Consequences of Stress Coping with Stress-Cognitive, Emotional, Behavioral techniques

Unit 5 **(08)**

Practical Coursework : Self Awareness Time management matrix, SWOT analysis, Communication Emotional Intelligence: Stress Management: Type A and B theory

Course Outcomes:

i. Students use Self awareness techniques for understanding their own personality and learn to apply these techniques in everyday life.[PEO4] [PO-j]
ii. Students understand the concept of Emotional Intelligence and learn to enhance interpersonal relationship.[PEO3] [PO-g]
iii. Students learn time management skills and understand the importance of planning in their life.[PEO4] [PO-f]
iv. Students learn effective study skills and use of creativity in their overall learning process.[PEO5][PO-i]
v. Analysis their stress patterns and learn different ways of coping with stress.[PEO5] [PO-i]

Semester: II

Sr. No	Subject Title	Category of Course	Contact hours L	T	P	Credits
01	Open Elective / Science Elective	OEC/SEC	3	-	-	3
02	Process Loop Components	PCC	3	-	-	3
03	Digital Signal Processing	PCC	3	-	-	3
04	Instrument and System Design	PCC	3	-	-	3
05	Analytical Instrumentation	PCC	3	-	-	3
06	Process Loop Components Laboratory	LC	-	-	3	2
07	Digital Signal Processing Laboratory	LC	-	-	3	2
08	Instrument and System Design Laboratory	LC	-	-	2	1
09	Analytical Instrumentation Laboratory	LC	-	-	2	1
10	Liberal Learning Course	LLC	1	-	-	1
11	Constitution of India	MLC	2	-	-	2
	Total		**18**	**-**	**10**	**24**

PROCESS LOOP COMPONENTS

Teaching Scheme

Lectures: 3 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- To study various standards used in process industry.
- To understand operation of transmitter, convertors and final control elements.
- To study basic building block of Programmable Logic Controller.

Unit 1 **(08)**

Fundamentals of Process Control & Transmitters: Elements of process control loop, concept of process variables, set point, controlled variable, manipulated variable, load variable. Representation of process loop components using standard symbols (basic with reference to control loop), and Examples of process loops like temperature, flow, level, pressure etc. Need of transmitter (concept of field area & control room area), Need for standardization of signals, current, voltage and pneumatic signal standards, concept of live & dead zero, Signal conditioning (analog & digital) for RTD, T/C, magnetic flow meter, DPT, span & zero adjustment, Two wire transmitter, Electronic and pneumatic transmitters Electronic Differential Pressure Transmitter: Types, mounting (Installation), manifolds, calibration setup, Application of DPT for level measurement, Zero elevation, Suppression. SMART transmitter: Comparison with conventional transmitter, Block schematic. Converters: Difference between converter & transmitter, Pneumatic to current converter, Current to pneumatic converter

Unit 2 **(06)**

Types of control actions: Discontinuous: ON/OFF, Continuous: Proportional, integral, derivative, proportional-Integral, Proportional- Derivative, Proportional-Derivative-Integral, Anti-reset windup, Rate before reset Concept of bump less transfers in PID controller, Effect of process Characteristics on PID combination, control actions for various processes

Unit 3 **(06)**

Tuning of controller: Quarter Amplitude Decay Ratio, Loop disturbance, optimum control, Measure of quality, stability criteria
Tuning methods: Process Reaction Curve (open loop), Ziegler Nichols (closed loop), set point tuning Vs load disturbance tuning. PID with limitations (offset, saturation in D, & reset windup) rate before reset, PID variations & tuning, digital controller (position & velocity algorithms, effect of sampling time).Digital PID controllers: concept of velocity & position algorithm, block schematic of series and parallel combinations.

Unit 4 **(08)**

Programmable Logic Controller (PLC):Continuous versus Discrete Process Control,

ladder diagram using standard symbols, Architecture of PLC, Types of Input & Output modules (AI, DI, AO, DO), wiring diagram, Interfacing pneumatic & Hydraulic systems, Fixed & Modular PLC (Rack, Slot, Grouping), Specifications, manufacturers, PLC ladder diagram and instructions, PLC Programming for process applications.

Unit 5 **(08)**

Control valve: Necessity, comparison with other final control elements, Classification of control valves based on: Valve body. Construction, type of actuation, application etc. Construction, Advantages, Disadvantages & applications of Globe: single, double, 3way, angle, Gate, Needle, Diaphragm, Rotary valves, Ball, Butterfly.
Types of actuators: Construction, Advantages, Disadvantages & applications: Spring Diaphragm, Piston cylinder(power cylinder), Pneumatic, Hydraulic, Electro-hydraulic, Electric, and smart actuators. Control valve terminology: Range ability, turndown, valve capacity, Air to open, Air to close, valve gain etc. Control valve characteristics: Inherent & installed Control valve accessories. Positioners: Application/Need, Types, Effect on performance of control valves. Volume boosters, Pressure Boosters, Reversing relay, Solenoid valves, Air lock, position indicating switches, Electro pneumatic converter, Hand wheel.

Unit 6 **(06)**

Explosion Proof Housing, Encapsulation, Sealing, & Immersion, Purging systems Hazardous area classification & intrinsic safety, Concept of safety cycle, HAZOP, fault tolerance and safety integrity level

Course Outcomes:

i. Configuration of transmitters, convertors.[PEO1][PO-l]
ii. Selection of transmitter, convertor and final control element.[PEO2][PO-c]
iii. Demonstrate PLC programming skill for industrial application.[PEO1][PO-m]

Text Books:

1. Curtis Johnson, “Process Control and Instrumentation Technology, Prentice-Hall of India Fourth ed., 1997.
2. Norman A. Anderson, “Instrumentation for Process Measurement and Control”, CRC Press, Third ed., 1980.
3. B. G. Liptak, “Process Control, Instrument Engineering Hand book”, Chilton Book Company, Third ed., 1995.
4. Gary Dunning, “Introduction to Programmable Logic Controller”, Cengage Learning India Pvt. Ltd., Third ed., 2006.
5. John W. Webb, “Programmable Logic Controllers”, Prentice Hall, Fourth ed., 1999.

Reference Books:

1. E. B. Jones , “Instrument Technology”, Butterworth’s, Forth ed., 1985
2. A.B. Corripio, “Tuning of Industrial Control System”, ISA, Second ed., 2001
3. William Andrews, “Applied Instrumentation in Process Industries”, Gulf, Second ed., 1979.
4. Control Valve Handbook, Fisher Controls International, Inc. Third ed., 2001.

DIGITAL SIGNAL PROCESSING

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	Mid-Sem – 30 Assignments, Quiz -20 End-Sem Exam- 50

Objectives:

- To study different types of digital signal processors and their architectures.
- To study and understand frequency response characteristics of LTI systems
- To study and design various structures of FIR and IIR filters
- To understand Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)

Unit 1 **(06)**

Digital Signal Processor: Harvard architecture and modified Harvard architecture. Introduction to fixed point and floating point DSP processors, architectural features, Computational units, bus architecture and memory architecture, data addressing, address generation unit, program control, program sequencer, pipelining, interrupts, features of external interfacing, on-chip peripherals, hardware timers, host interface port, clock generator, SPORT

Unit 2 **(08)**

Programming of DSP Processor Addressing modes, Instruction set, Programming tools such as DSP Assembler, IDE environments like CCS for DSP chip or visual DSP for Analog DSP chips, programming using DSP processor, I/O Programming

Unit 3 **(08)**

Finite Impulse Response Filters Introduction to finite impulse response filters, linear phase filters, symmetric & anti –symmetric filters, Design of FIR filter: windowing method, analysis of different types of windows, frequency sampling method, optimal equi-ripple, FIR differentiators

Unit 4 **(08)**

Infinite Impulse Response Filter Introduction to Infinite Impulse Response filter, Butterworth, Chebyshev approximation. Design of IIR filters: Impulse invariant method, bilinear transformation, approximation derivative method, IIR filters design using least square method: Pade approximation. Frequency transformations: low pass to high pass, band pass, band reject

Unit 5 **(06)**

Changing the sampling rate, Down sampling, Up sampling, Fractional rate changes, Noble identities, Polyphase Decomposition Narrowband filter banks, Delay Systems,

Integer sampling rate converters, Rational sampling rate converters, Multirate filter realization structures, subband processing

Unit 6 **(06)**

Formal definition , Wavelet transform ,Basic idea, Wavelet compression, Comparison with wavelet transformation, Fourier transformation and time-frequency analysis, Continuous wavelet transform, Discrete wavelet transform, Complex wavelet transform, Dual wavelet

Course Outcomes:

i. Ability to apply the various programming techniques on DSPs.[PEO2][PO-a,k]
ii. Ability to design FIR and IIR filters using different techniques.[PEO1][PO-e]
iii. Ability to determine the frequency, steady state and transient response of LTI systems.[PEO1][PO-a,e]
iv. Ability to apply the DFT and FFT methods for various signals and determine their frequency response.[PEO1][PO-e]

Text Books:

1. Proakis, Manolakis, "DSP Principles, algorithms and applications-, Pearson, Fourth ed., 2009.
2. Oppenheim and Schafer, "Discrete time signal processing", Pearson Publication, Second ed., 2007.

Reference Books:

1. TMS320C67XX DSP Reference set, Vol. 2 1999
2. P. Lapsley, J. Bier, A. Shoham, E. A. Lee, "DSP processor fundamentals: Architecture and features", IEEE Press, 1997.
3. Rulpph Chassaing, "DSP and Applications with TMS320C673 & TMS320C716", Wiley IEEE, Second ed.
4. A Antoniou, "DSP filter analysis and Design", McGraw Hill, 1979.
5. Avtarsingh, S. Srinivasan, "DSP Implementation using DSP microprocessors with examples" from TMS320C54XX", 2004.

INSTRUMENT AND SYSTEM DESIGN

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	Mid-Sem – 30 Assignments, Quiz -20 End-Sem Exam- 50

Objectives:

- Understand the need of requirements of Instrument and Systems**.**
- Study the various noises encountered while designing electronic circuits, instrument, systems and its elimination method.
- Understand enclosures design guide lines, cable design guide lines, PCB design guidelines.
- Analyze reliability of an Instrument and System.

Unit 1 **(08)**

Basic Concept of Instrumentation Design, Needs Analysis :with respect to systems deployed in; Medical, Industrial, Test and Measurement, Home Appliances, Military
Functional requirements & Specifications, Impact on the design due to adverse Electrical, Thermal and Mechanical Operational Environments

Unit 2 **(08)**

Noise Sources, Electrical, Magnetic, RF, Static, Ground Loops, Shielding, near and far field, shielding effectiveness, absorption and reflection loss, shielding with magnetic material, contact protection, glow and arc discharges, loads with high inrush current, Inductive and resistive load contact protection networks for inductive loads, intrinsic noise sources

Unit 3 **(06)**

ESD, inductive charging human body model, ESD protection in equipment, software in ESD protection ,Sensitive devices, input filters, clamping suppressors

Unit 4 **(08)**

Electronic design guideline Noise in electronic circuits. Capacitive and inductive coupling and effect of shield, shielding to prevent magnetic radiation, co-axial and twisted pair cable, grounding, safety ground, signal ground, single and multi point ground, Hybrid ground, grounding of cables shields, Ground loops and low frequency and high frequency analysis of common mode signals, guard shields

Unit 5 **(06)**

Enclosure Design Guidelines. NEMA, DIN, BSI, ANSI standards Index protection (IP), cable design guidelines; Printed circuit board design guideline, layout scheme, grid systems, PCB size, Design rules for digital circuits, and Design rules for analog circuits, single and multilayer PCB, CE / Underwrites Laboratories (UL) Compliance

Unit 6 **(06)**

Reliability, bath tub curve, Reliability for series parallel system, MTTF, MTTR, MTBF, availability, Redundancy and stand by systems.

Course Outcomes:

i. An ability to analyze the requirement of Instrument and systems.[PEO1][PO-e]
ii. An ability to design various electronic circuits, noises identification and appropriate elimination methods related to instrument and system[PEO2][PO-e]
iii. An ability to select, design appropriate enclosure, cables, PCB.[PEO2]PO-c]
iv. An ability to estimate, analyze, improve the reliability of instrument and system [PEO2][PO-k]

Text Books:

1. Henry OTT, "Noise reduction Techniques in Electronics Circuit", Wiley International, Second ed., 2009.

Reference Book:

1. Balguruswamy, "Reliability Engineering", TATA McGraw-hill Publication, Third ed. , 2005
2. Walter C. Bosshart, "Printed Circuit Board", Tata McGraw-Hill publication, Third ed. ,2009.

ANALYTICAL INSTRUMENTATION

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- Understand principles of instrumental analysis
- Study the theory and design of analytical instruments
- Apply problem-solving skills applicable to real-world problems

Unit 1 **(05)**

Introduction to Chemical instrumental analysis, advantages over classical methods, classification: Spectral, electro analytical and separative methods, Interaction of radiation with matter, Laws of photometry (Beer and Lambert's law), Deviation from Beer's law, working of filters, prism and grating monochromators, concept of design of analytical instrument

Unit 2 **(10)**

Colorimeters, online colorimeter for process applications, turbidity meter, UV-Visible spectrophotometers and its types with its optical system design, IR spectrophotometers, X-ray spectroscopy

Unit 3 **(06)**

Emission Spectra, Quantitative measurements, Flame Photometer and its applications , concept of design atomic absorption spectrophotometer, spectrum interpretation, interferences, applications of atomic absorption spectrophotometer

Unit 4 **(08)**

Classification of Chromatographic methods, Gas chromatography, Process Gas Chromatograph, Liquid Chromatography, High Performance Liquid Chromatography (HPLC)

Unit 5 **(08)**

Different types of gas analyzers for measurement of Oxygen, NO_2,ammonia, carbon dioxide and hydrocarbons , Real world applications : Environmental monitoring system, real time gas leakage monitoring working principle and applications of laboratory instruments : centrifuge, oven, stirrers

Unit 6

(05)

Working principle, analyzers and detector types of mass spectrometer, applications

Course Outcomes:

i. Ability to design and implement a given real world problem with emphasize on safe use of analytical instruments. [PEO2] [PO-c]
ii. Ability to select and use an analytical instrument in the physical, chemical and biological world and appreciate role of instrumentation. [PEO3] [PO-d]
iii. Familiarize with current literature, research in analytical instrumentation. [PEO2] [PO-j]

Text Books:

1. Willard, Merritt, John AurieDean, "Instrumental Methods of Analysis", CBS Publishers & Distributors, New Delhi, Seventh ed., 1988.
2. R. S. Khandpur, "Handbook of Analytical Instruments", Tata McGraw–Hill Publications, Second ed., 2006.
3. Skoog, Holler, Nieman, "Principles of Instrumental Analysis", Thomson books-cole publications, Sixth ed., 2006.

Reference Books:

1. Bela G Liptak, "Analytical Instrumentation Handbook", Chilton, Second ed., 1994.
2. Leslie S Ettre, Albert Zlatkis, "The Practice of Gas Chromatography", John Wiley and son's publication, First ed., 1967.

PROCESS LOOP COMPONENTS LABORATORY

Teaching Scheme

Lab : 3 hrs/week

Examination Scheme

Continuous Evaluation - 50

Practical Exam- 50

Objectives:

- To design transmitter for specific application
- To Characterize converter, final control element used in industry
- To implement logic using Programmable Logic Controller

1. Design of signal conditioning for a K-type thermocouple/ RTD
2. Development of mathematical model of control valve
3. Configuration of D.P Transmitter and its application for flow
4. Calibration of I/P converter
5. Tuning of PID controller
6. Study of control valve & plot the characteristics of control valve
7. Implementation of Discrete control using PLC programming
8. Implementation of Timer for a given applications using PLC
9. Implementation of Counter for a given applications using PLC
10. Interfacing PLC to hydraulic circuits
11. Interfacing PLC to Pneumatic circuits
12. Designing intrinsic safety circuits (Zener barrier)

Course Outcomes:

i. An ability to apply knowledge of design of analytical with emphasize on safe use of analytical instruments. [PEO2] [PO-c]

ii. Ability to select and use an analytical instrument in the physical, chemical and biological world and appreciate role of instrumentation. [PEO3] [PO-d]

iii. An ability to identify, formulate and solve a problem based on spectroscopy and chromatography analysis [PEO1] [PO-e]

DIGITAL SIGNAL PROCESSING LABORATORY

Teaching Scheme	**Examination Scheme**
Lab : 3 hrs/week	Continuous Evaluation - 50
	Practical Exam- 50

Objectives:

- To understand the architecture of the available DSP kit and implement different programming logics on it.
- To implement DFT, FFT and IDFT (Inverse Discrete Fourier Transform) on various signals.
- To design and implement FIR and IIR filters using different techniques.
- To identify the effect of finite word length calculations.

1. Discrete Fourier Transform
2. Fast Fourier transforms
3. Design and implement FIR filter using windowing method
4. Design and implement IIR filter using Butter worth approximation
5. Design and implement IIR filter using Chebeshev approximation
6. IIR filters design using least square method
7. Sine/square wave generation
8. FIR filters implementation
9. IIR filters implementation
10. FFT implementation
11. Effect of finite word length calculations
12. Practical Based real signal acquisition & analysis

Course Outcomes:

i. Ability to generate various signals from DSP kit and perform convolution of two signals.[PEO1][PO-a, e]
ii. Ability to implement and determine DFT, FFT and IDFT of signals.[PEO1][PO-e]
iii. Ability to determine the frequency responses of various signals. [PEO1] [PO-a]
iv. Ability to apply the knowledge of various techniques to design FIR and IIR filters using MATLAB. [PEO1][PO-e, k]

INSTRUMENT AND SYSTEM DESIGN LABORATORY

Teaching Scheme	**Examination Scheme**
Lab : 2 hrs/week	Continuous Evaluation - 50
	Oral Exam- 50

Objectives:

- Understand the practical aspect of shielding, cabling and noises in electronics circuits
- Design, implementation and realization of application specific measurement, analysis and Control system. (Mini project)

Contents:

Students are required to develop various modules required for their final year project, or a minim project e.g. power supply, processor module, interfacing module, display and signal conditioning module. The PCB and enclosure design is part of the activity of this subject. Testing of various modules as per industrial standards and practices is part of the experimental work. System Design Selection of sensors, signal conditioning, standard signals and noise considerations of typical systems

Course Outcomes:

i. Designing and implementation of mini project which includes measurement of parameter signal processing, controlling, debugging related to objectives defined in the problem statement. [PEO1,2,3][PO-e, k, d, l].

ANALYTICAL INSTRUMENTATION LABORATORY

Teaching Scheme	**Examination Scheme**
Lab : 2 hrs/week	Continuous Evaluation- 50
	Oral Exam- 50

Objectives:

- Understand various specification parameters of analytical instruments such as calibration, linearity, accuracy and repeatability
- Study safety criterions for analytical instruments
- Realize and implement spectroscopy and chromatography applications
- Assignments/problem statements based on the following techniques/instruments

1. To find out transmittance and absorbance of a given sample using colorimeter
2. Qualitative and quantitative analysis using UV-Visible spectrophotometer
3. To analyze a given water sample using turbidity meter
4. To detect hydrocarbon contents from a gas sample
5. To design low cost analytical instrument

Course Outcomes:

i. An ability to apply knowledge of design of analytical with emphasize on safe use of analytical instruments. [PEO2] [PO-c]
ii. Ability to select and use an analytical instrument in the physical, chemical and biological world and appreciate role of instrumentation. [PEO3] [PO-d]
iii. An ability to identify, formulate and solve application based problem on chemical instrumental analysis [PEO1] [PO-e]

LIBERAL LEARNING COURSE

Teaching Scheme	**Examination Scheme**
Lectures : 1 hr/week	Continuous Evaluation- 50 Presentation- 50

Objectives:

- To understand and master the learning process
- To identify topic and define the learning

Course Contents:

Identification of topic and resources, scope, and synthesize viewpoints for the areas such as performing arts, basic Sciences, business, philosophy, sports and athletics, defense studies and education

Course Outcomes:

i. Ability to exhibit self learning capabilities and its use in effective communication. [PEO3] [PO-g]
ii. An ability to inculcate impact of various areas to relate with society at large. [PEO4] [PO-h]

CONSTITUTION OF INDIA

Teaching Scheme

Lectures : 2 hrs/week

Examination Scheme

Mid-Sem – 30
Assignments, Quiz -20
End-Sem Exam- 50

Objectives:

- To help students understand the basic foundation of our nation as well as to understand the basic law for the governance of our nation.
- Understanding the history and the different types of Constitutions.
- Understanding the importance of the Constitution. Understanding the different aspects considered by the framers while framing the Constitution.
- To know and understand the different rights enshrined in the Constitution and understand the rights and duties of the government.
- To understand the basis and procedure of amendments and the different important amendments.
- To know the different aspects of the Union and the State Executive.
- To know how our country was founded, who founded it, what our rights are, what life was like, how life has changed, how the rights still apply today.

Unit 1 **(05)**

Preamble to the constitution of India. Fundamental rights under Part – III, details of Exercise of rights, Limitations & Important cases

Unit 2 **(10)**

Relevance of Directive principles of State Policy under Part – IV, Fundamental duties & their significance

Unit 3 **(06)**

Union Executive – President, Prime Minister, Parliament & the Supreme Court of India

Unit 4 **(08)**

State executive – Governors, Chief Minister, State Legislator and High Courts

Unit 5 **(08)**

Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions

Unit 6 **(05)**

Electoral process, Amendment procedure, 42^{nd}, 44^{th}, 74^{th}, 76^{th}, 86^{th} and 91^{st} Constitutional amendments

Course Outcomes:

i. Understood the Constitution which is the combination of the positive aspects of other Constitutions.[PEO4][PO-i]

ii. Interpretation of the Preambles[PEO4][PO-i]

iii. Gained confidence on our Constitution by knowing it better[PEO4][PO-i]

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India by (Students ed.) Prentice – Hall EEE, Nineteenth ed., 2001.
2. Charles E. Haries, Michael. S. Pritchard and Michael J. Robins, "Engineering Ethics", Thompson Asia, Fourth ed., 2009.

Reference Books:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.