SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Electronic Instrumentation & Control Engineering

VI Semester

Effective for the students admitted in year 2021-22 and onwards.

B. Tech. Electronic Instrumentation & Control
3rd Year – VI Semester

THEORY												
S.No.	Category	Course		Contact hrs/ week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
1	DC	**6EI4-01**	Neural Network and Fuzzy Logic Control	3	0	0	3	30	70	**100**	**3**
2		**6EI4-02**	Process Instrumentation	3	0	0	3	30	70	**100**	**3**
3		**6EI4-03**	Analytical Instrumentation	3	0	0	3	30	70	**100**	**3**
4		**6EI4-04**	Power Electronics	3	0	0	3	30	70	**100**	**3**
5		**6EI4-05**	Embedded Systems	2	0	0	2	30	70	**100**	**2**
6	**DE**	**Department Elective: Any One**		2	0	0	2	30	70	**100**	**2**
		6EI5-11	Virtual Instrumentation								
		6EI5-12	Digital Image Processing								
		6EI5-13	Robotics								
		Sub-Total		**16**	**0**	**0**		**180**	**420**	**600**	**16**
PRACTICAL & SESSIONAL											
7	DC	**6EI4-20**	Control System Simulation Lab	0	0	3	3	60	40	**100**	**1.5**
8		**6EI4-21**	Power Electronics Lab	0	0	3	3	60	40	**100**	**1.5**
9		**6EI4-22**	Analytical Instrumentation Lab	0	0	2	2	60	40	**100**	**1**
10	**UI**	**6EI7-50**	Mini Project	0	0	4	3	60	40	**100**	**2**
11	**CCA**	**6EI8-00**	Co-Curricular Activities	0	0	4	-	60	40	**100**	**2**
		Sub- Total		**0**	**0**	**16**	**-**	**300**	**200**	**500**	**8**
		TOTAL OF VI SEMESTER		**16**	**0**	**16**	**-**	**480**	**620**	**1100**	**24**

L: Lecture, **T**: Tutorial, **P**: Practical, **C**r: Credits
ETE: End Term Exam, **IA**: Internal Assessment

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

6EI4-01: Neural Network and Fuzzy Logic Control

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To impart knowledge of artificial neural network and fuzzy logic systems

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn concepts, architecture and working of artificial neural networks
CO-2: Understand supervised and unsupervised learning algorithms
CO-3: Understand Fuzzy set theory and operations, Fuzzy Relations and Fuzzy inference system
CO-4: Design Fuzzy logic controller for industrial applications.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS:** Artificial neural network and their biological motivation, Terminology, Introduction to ANN Architecture, Models of neuron, Topology, Characteristics of artificial neural networks, Types of activation functions.	6
3.	**LEARNING METHODS:** Error correction learning, Hebbian learning, Perceptron, XOR Problem, Perceptron learning rule, Convergence theorem, Adaline.	6
4.	**SUPERVISED AND UNSUPERVISED LEARNING:** Multilayer Perceptron, Back propagation learning algorithm, Momentum factor, Radial basis function network, Recurrent neural networks, Hopfield neural network, Competitive learning neural networks, Kohonen self organizing feature map, Counter propagation network.	7
5.	**FUNDAMENTALS OF FUZZY LOGIC:** Introduction to classical sets - Properties, operations and relations; Fuzzy sets, Uncertainty, Operations, properties, cardinalities, membership functions. Fuzzy relations**:** Fuzzy cartesian product, Composition-Max min and Max-product composition, Tolerance and Equivalence relations.	8
6.	**FUZZY INFERENCE SYSTEMS:** Fuzzification, Membership value assignment, Defuzzification to crisp sets, Defuzzification methods, Natural language, Linguistic hedges, Fuzzy rule base system, Graphical techniques of inference.	8
7.	**FUZZY CONTROL SYSTEM:** Basic architecture of Fuzzy logic controller, Industrial applications- Aircraft landing control, Fuzzy Engineering process control.	4
	Total	40

Suggested Books:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons, 2010.
2. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
3. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006
4. S. Haykin, "Neural Networks, A Comprehensive Foundation", Pearson Education Inc., 2008.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-02: Process Instrumentation

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To gain knowledge about control of Heat Exchanger, Boiler, Distillation column control, Dryer, Evaporator, Continuous and batch reactor.

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

CO-1: Understand the working of Heat Exchanger, Boiler and its control
CO-2: Learn design procedures for control of Distillation columns
CO-3: Learn the principles and design of controller for Dryers, Reactors
CO-4: Identify various control schemes for Pumps and Compressor

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**HEAT EXCHANGER:** Operation of heat exchanger, Controlled and manipulated variables in heat exchanger control problem, Degrees of freedom analysis, Instrumentation for feedback, Feed-forward, Feedback-Feed forward control, Cascade control strategies for heat exchanger, PID Tuning methods for heat exchangers, Scaling, Types of scaling, Examples of scaling	6
3.	**BOILER CONTROLS:** Operation of boiler, Manipulated and controlled variables in boiler control, Safety interlocks and burner management system, Instrumentation for boiler pressure controls, Air to fuel ratio controls, Boiler drum level controls, Steam temperature control, Optimization of boiler efficiency, Boiler blow down, Furnace draft, Ratio control, Selective control, Split range control, Adaptive control, PID tuning methods for boilers.	6
4.	**DISTILLATION CONTROLS:** Operation of distillation column, Manipulated and controlled variables in distillation column control, Instrumentation for flow control of distillate, Top and bottom composition control, Reflux ratio control, Pressure control schemes, Degree of freedom analysis, Different methods to control distillation with case study.	9
5.	**DRYER CONTROLS AND EVAPORATOR:** Types and operation of dryers, Controlled and manipulated variables in dryer control problem, Instrumentation for feedback and feed-forward control of various types of dryers, Types and operation of evaporators, Controlled and manipulated variables in evaporator control problem, Instrumentation for feedback, Feed-forward and cascade control strategies for evaporators.	7
6.	**CHEMICAL REACTOR CONTROLS:** Types of reactions and reactors, Factors governing the conduct of reaction, Stability of reactors, Time constant, Effects of lag, Flow control, Temperature control, pH control, End point detection of continuous and batch reactors, Sequential & logic control in batch process, Batch production management.	6
7.	**PUMPS, COMPRESSORS CONTROLS:** Pumps: Types, Basic controls, Multi-pump system controls. Compressors: Types, Basic controls, Multi-compressor system controls.	5
	Total	40

Suggested Books:

1. Instrument Engineers' Handbook: Process Control: B.G. Liptak, Chilton.
2. Optimization of Industrial Unit Processes Bela G. Liptak
3. Boiler Control Systems: David Lindsey, Mc GRAW- HILL
4. Process Control Systems- F.G.Shinskey, TMH

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-03: Analytical Instrumentation

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To impart knowledge of various analytical methods used for solid, liquid and gas sample analysis.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn principles and operation of Spectrophotometry
CO-2: Understand spectroscopic methods and their applications
CO-3: Identify various methods for Gas, Liquid and Solid analysis
CO-4: Learn functioning of Chromatography and applications.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**ELECTROMAGNETIC RADIATION AND ITS INTERACTION WITH MATTER**: Beer's law, Spectral methods of analysis, Absorption spectroscopy, Radiation sources, Monochromators, Filters, Prisms, Diffraction gratings, Detectors, Choice of solvents, UV-Visible spectrometers, Single-beam and double-beam instruments.	7
3.	**INFRARED SPECTROPHOTOMETER:** IR sources, Cells, Detectors, Sample preparation, Analysis using Attenuated Total Reflectance (ATR), Atomic absorption spectrometry (AAS), Wavelength choice, Sources, Cells, Detectors, Flame emission spectrometry, Atomic fluorescence spectrometry.	7
4.	**X-RAY SPECTROSCOPY:** X-ray absorption methods, X-ray fluorescence methods, X-ray diffraction, Radioactive measurement, Units of radioactivity, Application of radio-nuclides in analysis, Radioactivity detectors, Nuclear magnetic Resonance (NMR) spectroscopy, Basic principles, Continuous-wave NMR spectrometer, Pulsed Fourier Transform NMR spectrometer, NMR applications.	8
5.	**SAMPLING:** Sample collection for gas, liquid, and solid analysis, pH measurement, Basic principles, Ion selective electrodes, Glass and reference electrodes, pH meter and its calibration, Electrical conductivity measurement, Measuring circuit, Water and steam purity measurement using electrical conductivity, Oxygen measurement, Paramagnetic oxygen analyzers, Ceramic electrode for high temperature oxygen measurement, Dissolved oxygen measurement.	9
6.	**FLUE GAS ANALYSIS FOR POLLUTION CONTROL:** Measurement of CO, Carbon Di-Oxide, Dust and smoke measurement, Chromatography, Basic principles of liquid and gas chromatography, Column details, Detectors for chromatography, Thermal conductivity detector, Flame ionization detector, Flame photometric detector, Electron capture detector, Effect of temperature programming, High pressure liquid chromatography (HPLC).	8
	Total	**40**

Suggested Books:

1. Braun, Robert D., Introduction to Instrumental Analysis, Pharma Book Syndicate, Hyderabad. 2006.
2. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
3. Ewing, G.W., Instrumental Methods of Analysis, McGraw Hill, Singapore, 5th Edition, 1992.
4. Bela G. Liptak, Instrument Engineers' Handbook, Volume One: Process measurement and analysis, CRC Press, 4th Edition, 2003.
5. Considine, D.M. Process/Industrial Instruments and Controls Handbook, McGraw Hill, Singapore, 4th Edition, 1993.
6. Sherman, R.E. and Rhodes L.J., Analytical Instrumentation, ISA Press, New York, 1996.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-04: Power Electronics

Credits: 03
3L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 3 Hours

Course Objectives: To impart knowledge of theory and applications of power electronics systems

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand working of power semiconductor devices.
CO-2: To develop power converters used for the control of DC and AC.
CO-3: To conceptualize and analyze the issues related to recent converter operation
CO-4: Identify applications of power electronic devices.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**POWER SEMICONDUCTOR SWITCHES:** Introduction, basic characteristic and working of Power Diode, Power Transistor, GTO, Power MOSFET and IGBT. SCR characterstics, Voltage, Current, Load commutation, Driver circuits, Turn-on and Turn-off characteristics.	05
3.	**AC TO DC CONVERTERS:** Natural commutation, Single-phase and three-phase bridge rectifiers, Semi controlled and fully controlled rectifiers, Dual converters.	04
4.	**DC TO DC CONVERTERS:** Buck, Boost, Buck-Boost converters	06
5.	**DC TO AC CONVERTERS:** Single-phase VSI, Three-phase VSI, Voltage control, Pulse-width modulated (PWM) inverters, Single and multiple PWM, Sinusoidal PWM (SPWM), Modified SPWM, Space vector modulation and hysteresis band current control PWM techniques. PWM based inverters and resonant converters	09
6.	**AC TO AC CONVERTERS:** Single-phase AC voltage controllers, Multistage sequence control, single and three phase cycloconverters, Introduction to Integral cycle control, Power factor control and Matrix converters.	08
7.	**APPLICATIONS OF POWER ELECTRONICS:** UPS, SMPS and Reactive power compensation.	07
	Total	40

Suggested Books:

1. Rashid M. H, Power Electronics - Circuits, Devices and Applications, Prentice Hall, New Delhi, 4thEdition, 2013.
2. Dubey G. K, Doradla S.R, Joshi and Sinha R.M, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 2010.
3. John G. Kassakian, Principles of Power electronics, Addison Wesley, 1991.
4. P. S. Bimbhra, Power Electronics, Khanna Publishers, 5th Edition, 2012.
5. Vedam Subramanyam K, Power Electronics, New Age International Publishers, New Delhi, 2nd Edition, 2012.
6. Mohan, Undeland and Robbins, Power Electronics: Converters, Applications and Design, John Wiley and Sons, New York, 1995.
7. Joseph Vithyathil, Power Electronics, McGraw Hill, New York, 1995.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-05: Embedded Systems

Credits: 02 **Max. Marks: 100 (IA:30, ETE:70)**
2L:0T:0P **End Term Exam: 2 Hours**

Course Objectives: To familiarize the students with the fundamentals of embedded system architecture, its basic hardware and software elements, software engineering practices that are used during the system development process.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn the architecture and functioning of advanced processors
CO-2: Learn the Programming concepts of embedded systems.
CO-3: Understand the real time operating systems

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**INTRODUCTION TO EMBEDDED SYSTEMS:** Embedded system, processor in the system, Hardware and software components, System-on chip.	03
3.	**REVIEW OF PROCESSOR AND MEMORY**: General-purpose processors, Single-purpose processors, Application specific processors, CISC and RISC processor architecture, ARM processors, Memory devices, Processor and memory selection for an embedded system, Interfacing processor, Memory and I/O devices, 8/16 bit microcontrollers.	06
4.	**DEVICES AND BUSES**: Review of I/O and timer devices, Parallel communications using ISA, PCI and other buses, Serial communication using I^2C, CAN, USB and advanced buses, Interrupt serving mechanism, Device drivers.	06
5.	**EMBEDDED PROGRAMMING**: Review of programming in ALP and in C, Embedded programming in C++, Memory organization, Compiler and cross compiler.	06
6.	**REAL TIME OPERATING SYSTEMS:** Operating system services, I/O subsystems, Network operating systems, Embedded system operating systems, Interrupt routines in RTOS environment.	04
7.	**HARDWARE-SOFTWARE CO-DESIGN**: Embedded system design and co-design issues, Software tools for development of an embedded system	04
	Total	30

Suggested Books:

1. Kamal R., "Embedded Systems – Architecture, Programming and Design", Tata McGraw-Hill Publishing Company Limited.
2. Vahid F. and Givargis T., "Embedded System Design – A Unified Hardware/Software Introduction", Wiley India.
3. Maxfield C. M., "The Design Warrior's Guide to FPGAs – Devices, Tools and Flows", Newnes.
4. Berger A. S., "Embedded System Design – An Introduction to Processes, Tools and Techniques", CMP Books.
5. Labrosse J. J., "Embedded Systems Building Blocks", 2nd Ed., CMP Books.
6. Barr M., "Programming Embedded Systems in C and C++", O'Reilly.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI5-11: Virtual Instrumentation
(Department Elective)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To impart knowledge of virtual instrumentation and software tools

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand the concept of virtual instrumentation
CO-2: Learn data flow programming using LABVIEW software
CO-3: Learn communication and interfacing protocol for VI models.
CO-4: Develop virtual instrument for modeling, monitoring and control of real time processes.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**Introduction to Virtual Instrumentation:** Historical perspective, Classification of different instruments / instrumentation system. Definition and architecture of virtual instrumentation system, salient features and application area of virtual instrumentation.	05
3.	**Data Flow Programming Techniques:** Graphical programming in data flow, comparison with conventional programming, popular data flow and VI software packages. Building a VI front panel and block diagram, sub VI, for and while loops, case and sequence structure, formula nodes, local and global , string and file I/O, array and clusters, charts and graphs, attributes nodes.	07
4.	**Data Acquisition Basics:** ADC, DAC, D/O, counters and timer, PC hardware structure, timing, interrupts, DMA, software and hardware installation, Configuring data acquisition hardware using the drives in application software, use of DAQ library functions for different analog and digital input/output operations.	06
5.	**Common Instrument Interfaces:** Current loop, RS 232, RS485, GBIP. Use of library functions to communicate with different instruments.	05
6.	**Use of Measurement Analysis Tools:** Measurement of Max, Min, Peak-Peak voltage, Mathematical tools, time period of a signal, power spectrum and logging Fourier transform, Correlation methods, windowing and filtering. **Building a web based virtual instrument:** Networking basics for office and industry application.	06
	Total	30

Suggested Books:

1. Lisa, K. Wells & Jeffery Travis / Lab VIEW For every one Prentice Hall, 19972.
2. S. Gupta / P.C Interfacing for data Acquisition & Process Control, 2nd Edition / Instrument Society of America, 1994.
3. Gray Johnson / Lab VIEW Graphical Programming 2nd Edition / Tata McGraw Hill, 1997.
4. Bitter, Mohiuddin, Nawrocki / Advanced Cal VIEW Programming Techniques.
5. NI manual for LABVIEW

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI5-12: Digital Image Processing
(Department Elective)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To impart knowledge of digital image processing techniques and applications.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand fundamentals of image processing.
CO-2: Learn the concepts of image restoration and compression
CO-3: Explore the concepts of image segmentation

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**BASICS CONCEPTS OF IMAGE PROCESSING:** Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, Color image representation.	05
3.	**IMAGE TRANSFORMATION & FILTERING:** Intensity transform functions, Histogram processing, Spatial filtering, Fourier transforms and its properties, Frequency domain filters, Colour models, Pseudo colouring, Colour transforms, Basics of wavelet transforms.	06
4.	**IMAGE RESTORATION:** Image degradation and restoration process, Noise models, Noise filters, Degradation function, Inverse filtering, Homomorphism filtering.	06
5.	**IMAGE COMPRESSION:** Coding redundancy, Inter pixel redundancy, Psycho visual redundancy, Huffman coding, Arithmetic coding, Lossy compression techniques, JPEG compression.	06
6.	**IMAGE SEGMENTATION & REPRESENTATION:** Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region based segmentation, Boundary representation, Boundary descriptors.	06
	Total	30

Suggested Books:

1. Gonzalez & Woods, Digital Image Processing, Pearson education, 3rd Edition, 2008.
2. Jain Anil K., Fundamentals Digital Image Processing, Prentice Hall India, 2010.
3. Milan Sonka, Vaclav Hlavav, Roger Boyle, Image Processing, Analysis and Machine Vision, Thomson Learning, 2nd Edition, 2001.
4. Pratt W.K, Digital Image Processing, John Wiley & Sons, 3rd Edition, 2007.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI5-13: Robotics
(Department Elective)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To impart knowledge about robotics, its dynamics and applications

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn basic building block of robotics and automation
CO-2: Understand dynamics and control of robotics
CO-3: Gain knowledge about programming concepts used in robotics
CO-4: Find various application of robotics

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**BASICS OF ROBOTICS:** Concepts, Definition and origin of robotics, Different types of robots, Robot classification, Applications, Robot specifications.	06
3.	**INTRODUCTION TO AUTOMATION:** Components and subsystems, Basic building block of automation, Manipulator arms, Wrists and end-effectors, Transmission elements, Hydraulic, Pneumatic and electric drives, Gears, Sensors, Materials, User interface, Machine vision, Implications for robot design, Controllers.	05
4.	**KINEMATICS, DYNAMICS AND CONTROL:** Object location, Three dimensional transformation matrices, Inverse transformation, Kinematics and path planning, Jacobian work envelope, Manipulator dynamics, Dynamic stabilization, Position control and force control, Present industrial robot control schemes.	06
5.	**ROBOT PROGRAMMING:** Robot programming languages and systems, Levels of programming robots, Control of industrial robots using PLCs.	06
6.	**AUTOMATION AND ROBOTS:** Case studies, Multiple robots, Machine interface, Robots in manufacturing and non-manufacturing applications, Robot cell design, Selection of a robot.	06
	Total	30

Suggested Books:

1. Spong, M.W., Hutchinson, H., & Vidyasagar, M., Robot Modeling and Control, John Wiley (Wiley India Ed.), 2006.
2. Asfahl C.R, Robots and Manufacturing Automation, John Wiley & Sons, New York, 1992.
3. Klafter R.P, Chmiclewski T.A, Negin M, Robotics Engineering: Integrated approach, Prentice Hall, New Jersey, 1994.
4. Mikell P, Weiss G.M, Nagel R.N and Odrey N.G, Industrial Robotics, McGraw Hill, New York, 1986.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-20: Control System Simulation Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart practical knowledge of simulation of control systems

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Analyze the systems transient and frequency response
CO-2: Find response of systems for standard inputs
CO-3: Find stability analysis of given systems
CO-4: Design controller for the given system

Se. No.	Name of Experiments
1.	Introduction: Objective, scope and outcome of the course.
2.	Introduction to `MATLAB'. Computing control software, defining systems in TF, ZPK form.
3.	Use of for, while loops in MATLAB programming.
4.	(a) Plot step response a given TF and system in state-space. Take different valves of damping ratio and natural undamped frequency and observe the difference. (b) Plot ramp and impulse response for the same.
5.	For a given 2nd order system write a program to obtain time response specifications maximum overshoot, peak time, settling time etc.
6.	Write a program to check for the stability of a given closed loop system by (a) Finding close loop poles (b) using Routh's stability criterion.
7.	Sketch the root locus for a given system and determine the system gain. Also simulate the same using MATLAB.
8.	Sketch the Bode plot for a given system and analyses the stability. Also simulate the same using MATLAB and find the values of GM and PM
9.	Design of lead controller to satisfy given specifications using bode plot.
10.	Use MATLAB to plot Nyquist plot for a given system and comment upon stability.
11.	To design a PID controller for the given system to meet desired specifications. Observe the response using MATLAB.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-21: Power Electronics Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart practical knowledge of various power electronics devices

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn the characteristics and operation of thyristor family
CO-2: Design of controllers for various applications.
CO-3: Learn switching behavior and design of converter and inverter circuits

Se. No.	Name of Experiments
1.	Study the characteristics of SCR and observe the terminal configuration, measure the breakdown voltage, latching and holding current. Plot V-I characteristics.
2.	Perform experiment on triggering circuits for SCR. i.e. R triggering, R-C triggering and UJT triggering circuit.
3.	Study and test AC voltage regulators using Triac, anti parallel Thyristors and Triac & Diac.
4.	Study and obtain the waveforms for single-phase bridge converter.
5.	Perform experiment on single phase PWM inverter.
6.	Perform experiment on buck, boost and buck-boost regulators.
7.	Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic.
8.	Control speed of a single-phase induction motor using single phase AC voltage regulator.
9.	(i) Study single-phase dual converter (ii) Study speed control of dc motor using single-phase dual converter
10.	Study single-phase cyclo converter.
11.	Perform experiment on motor control – open loop & closed loop.
12.	Design, observe and perform experiment on various type of pulse generation from DSP/ FPGA platform. Perform experiment for PWM inverters and choppers.

SYLLABUS
3rd Year- VI Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
6EI4-22: Analytical Instrumentation Lab

Credits: 1 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:2P

Course Objectives: To impart practical knowledge of analytical instruments and their characteristics

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Find analytical parameters of air/gas
CO-2: Find characteristics of different solutions and find their analytical parameters
CO-3: Understand characteristics and working principle of Spectrophotometer
CO-4: Learn characteristics and working principle of Chromatograph

Se. No.	Name of Experiments
1.	To measure pH value of given solution using pH meter.
2.	To determine suspended particular matter using right volume air samples.
3.	Find out concentration of (Na or K) by flame photo meter in the given sample.
4.	To measure transmittance and absorption of a solution using Single beam Spectrophotometer.
5.	To study water analysis kit & measure pH, temperature, conductivity, dissolved O_2 of a given solution.
6.	To measure the conductivity of solution indicator controller.
7.	To study the analysis of flue gases.
8.	To study ion selective electrode.
9.	To study pH monitor and controller.
10.	To study gas/ liquid Chromatograph.