NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Teachers, Paper Setters and Examiners Guideline Manual

for

Third Year Instrumentation Engineering

Faculty of Engineering and Technology

SEMESTER – V and VI

W.E.F 2014 – 2015

Control System Components

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit I: Introduction to control system components	Lectures required	References
a	Comparison of different systems: hydraulic, pneumatic and electronic systems.	01	1 to 3, 9, 10
b	2-wire transmitters, buoyancy, differential pressure transmitters.	02	1 to 3, 9, 10
c	Temperature, electro-hydraulic transmitters.	01	1 to 3, 9, 10
d	Resistance-to-current converter, voltage-to-current converter.	02	1 to 3, 9, 10
e	Pneumatic to electric converter, electrical to pneumatic converter.	02	1 to 3, 9, 10
f	Square root extractor, integrator and totalizer.	01	1 to 3, 9, 10

Unit - II

Sr.No.	Unit II: Control Valves	Lectures required	References
a	Terminology, types and characteristics, Selection of control valves.	02	1 to 3, 9, 10
b	Concept of Cv, calculation of Cv and trim size.	02	1 to 3, 9, 10
c	Cavitation and flashing, Noise in control valves, testing of control valve.	02	1 to 3, 9, 10
d	Valve positioners: necessity, types and effect on performance of control valves.	01	1 to 3, 9, 10
e	Electrical, Pneumatic and Hydraulic Actuators, Electro-pneumatic and Electro-Hydraulic Actuators	02	1 to 3, 9, 10

Unit - III

Sr.No.	Unit III: PID Controllers and PLC	Lectures required	References
a	Pneumatic, hydraulic and Electronic PID controllers and their tuning.	03	1, 7 to 9
b	Relay ladder diagrams, introduction to programmable logic controllers (PLC).	01	1, 7 to 9
c	Architecture and specifications of PLC.	01	1, 7 to 9
D	Ladder Programming, Development of ladder diagrams for various applications.	02	1, 7 to 9
e	Advance PLC programming.	01	1, 7 to 9

Unit – IV

Sr.No.	Unit IV: Pneumatic and hydraulic components	Lectures required	References
a	Instrument air supply, air filter regulator, Simple pneumatic circuits, fluidic gates.	02	1 to 5
b	linear motors(piston- cylinder), rotary motors, non-return valves, directional control valve, pressure reducing valves.	02	1 to 5
C	Hydraulic power pack, pumps, Simple hydraulic circuits and transmission	02	1 to 5
d	Power cylinders, servomotors, DC valves.	02	1 to 5

Unit - V

Sr. No.	Unit V: Auxiliary components	Lectures required	References
a	Synchros, Servo motor, Stepper motor, Feeders and Dampers.	02	8 to 10
b	Intrinsic safety and components.	02	8 to 10
c	Gyroscope	01	8 to 10
d	Indicators and Alarm Annunicator.	02	8 to 10
e	Control Panel and their design.	01	8 to 10

Reference Books:

1. C.D.Jhonson , 'Process control and Instrument Technology' , Prentice-Hall of India.
2. D.Patranabis, 'Principles of process control', Tata McGraw-Hill.
3. N.A.Anderson, 'Instrumentation for process measurement and control', CRC Press.
4. Pipepinger, 'Industrial Hydraulics'.
5. Mujumdar, 'Pneumatic components and circuits', Tata McGraw-Hill.
6. I.J.Nagrath, M.Gopal., 'Control system Engineering', PHI..
7. JhonWebb, 'Programmable logic controllers', PHI.
8. Francis Raven, 'Automatic Control Engineering', McGraw-Hill.
9. Bela Liptak , 'Handbook of Instrumentation Engineers (process control)'.
10. Andrew Willams, 'Applied Instrumentation in process control (vol-1)', Gulf Publications.
11. http://nptel.iitm.ac.in

Digital Signal Processing

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit I:	Lectures required	References
a	Fourier series and Fourier transform & its properties.	02	1 to 3
b	Discrete time Fourier series & its properties.	01	1 to 3
c	Circular convolution, frequency response analysis of signal using DFT.	02	1 to 3
d	Linear filtering based on DFT FFT algorithms.	02	1 to 3
e	Use of FFT for spectral estimation, filtering & correlation	02	1 to 3

Unit - II

Sr.No.	Unit II:	Lectures required	References
a	Short Time Fourier Transform (STFT)	01	1 to 3
b	Introduction to multi-resolution transform.	01	1 to 3
C	Continuous wavelet transforms.	02	1 to 3
	Discrete Wavelet Transform (DWT)	03	1 to 3
	Simple application of DWT for noise filtering in one dimensional signal.	02	1 to 3

Unit - III

Sr.No.	Unit III:	Lectures required	References
a	Introduction to Finite Impulse Response Filter, FIR filter design using different windowing techniques & frequency sampling method.	02	1 to 3
b	Design of linear phase FIR filter.	02	1 to 3
c	Introduction to computer-aided design of linear phase FIR filter.	02	1 to 3
d	Basic structure of FIR system.	02	1 to 3

Unit – IV

Sr.No.	Unit IV:	Lectures required	References
a	Introduction to Infinite Impulse Response Filter.	02	1 to 3
b	Impulse invariance and bilinear transformation.	02	1 to 3
C	Design Specification of IIR Low pass filter and frequency transformation, Design of IIR filter using Butterworth, Chebyshev approximation.	02	1 to 3
d	Introduction to computer-aided design of IIR filter. Realization methods for IIR filter.	02	1 to 3

Unit - V

Sr. No.	Unit V:	Lectures required	References
a	Introduction to multirate DSP, Introduction to DSP hardware.	03	4
b	TMS320C67XX processor, applications of TMS320C67XX e.g. square wave generator, matrix multiplication.	03	4
c	Applications of DSP processor for biomedical, speech, image processing.	02	4

References:

1. Proakis, Manolakis "Digital Signal Processing: Principles, algorithms and applications", PHI.
2. Oppenheium, Schaffer ,"Digital Signal Processing", PHI.
3. A. Nagoor Kani , "Digital Signal Processing", Mc. Graw Hill.
4. Rulph Chassaing ,"Digital Signal Processing, applications using C & TMS320CSX DSK", WILLEY publication.
5. http://nptel.iitm.ac.in

Microcontroller & Application

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit I:	Lectures required	References
a	Microcontrollers & microprocessors, Embedded versus External memory devices.	02	1 to 6
b	8-bit & 16-bit microcontrollers, Commercial microcontroller devices.	04	1 to 6
c	8051 microcontrollers:- MCS-51 Architecture, Registers in MCS-51, 8051 pin description, 8051 connections, 8051 parallel ports, memory organization.	03	1 to 6

Unit - II

Sr.No.	Unit II:	Lectures required	References
a	8051 Addressing modes, 8051 Instructions and simple programs, stack pointers.	04	1 to 6
b	8051 Assembly Language Programming, Introduction to embedded-C, Concept of assembler directives, editor, linker, loader, debugger, simulator, emulator.	03	1 to 6
c	Integrated Development Environment (IDE), cross compiler, ISP. Interrupts in MCS-51, Timers and Counters, Serial Communication	02	1 to 6

Unit - III

Sr.No.	Unit III:	Lectures required	References
a	Applications of MCS-51 and 89C51 and 89C2051 microcontrollers, square wave generation, Rectangular waves, Pulse Generation, Pulse Width Modulation (PWM), Staircase Ramp Generation, Sine Wave Generation.	04	1 to 6
b	PIC Microcontrollers: Overview and features, PIC 16C6X/7X FSR (File Selection Register), PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC)	04	5

Unit – IV

Sr.No.	Unit IV:	Lectures required	References
a	Basic concepts in serial I/ Os, Interfacing of RS-232 & IEEE-484.	02	1 to 5
b	Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections.	02	1 to 5
C	Keyboard Interfacing, Interfacing 7-segment Displays, LCD Interfacing,	02	1 to 5
d	ADC and DAC Interfacing with 89C51 Microcontroller, 8051 Interfacing to External memory, 8051 Interfacing to the 8255.	02	1 to 5

Unit - V

Sr. No.	Unit V:	Lectures required	References
a	Introduction to PIC 16F8XX Flash Microcontroller, CISC and RISC Microcontrollers.	03	2, 4, 5
b	Introduction to AVR series microcontrollers. Introduction to ARM7 microcontroller.	02	2, 4, 5
c	Industrial Applications of Microcontrollers: Measurement Applications, Automation and Control Applications	03	2, 4, 5

References books:

1. Kenneth J. Ayala, '8051 Microcontroller Architecture, programming, & Applications', 2nd edition, Thomson learning.
2. Muhammad Ali Mazidi, 'The 8051 Microcontroller and Embedded Systems', Pearson Education.
3. Ajay V Deshmukh, 'Microcontrollers (Theory and Applications)', McGraw-Hill.
4. Jhon Peatman, 'Design with Microcontrollers', McGraw-Hill.
5. Jhon Peatman, 'Design with PIC Microcontrollers', Pearson Education.
6. Kenneth Hint, Daniel Tabak, 'Microcontroller: Architecture, Implementation, and programming', McGraw-Hill.
7. http://nptel.iitm.ac.in

Power Electronics

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit I: Power Family Components	Lectures required	References
a	Characteristics constructional details and working of Thyristor/SCR, Triac, Diac, SCS, SUS, LASCR	02	1 to 5
b	Methods of turning on an SCR, turn-on, turn-off mechanism and characteristic, device specifications, rating and nomenclature of SCR	01	1 to 5
c	SCR triggering circuits, R, RC, pulse and UJT triggering circuits, Protection circuits for SCR.	02	1 to 5
d	Multiple connection of SCR: series operation, parallel operation, string efficiency	02	1 to 5
e	Commutation of SCR: Natural and Forced commutation techniques.	02	1 to 5

Unit - II

Sr.No.	Unit II: Rectifier and Inverter	Lectures required	References
a	Controlled rectifier: Single phase and three-phase controlled rectifier circuits, with R, RL Load, with FWD, Dual converters.	04	1 to 5
b	Inverters: Principle of operation of series inverter, parallel inverter and bridge inverter, designing of commutating component.	03	1 to 5
c	Design and operation of UPS & SMPS.	02	1 to 5

Unit - III

Sr.No.	Unit III: AC Voltage Controllers and Cycloconverters	Lectures required	References
a	AC Voltage controllers: single-phase & three-phase with R and RL load	03	1 to 5
b	Cycloconverter: Single-phase and Three-phase Cycloconverter.	03	1 to 5
c	Induction heating and dielectric heating, Resistance welding.	02	1 to 5

Unit – IV

Sr.No.	Unit IV: Chopper and Speed Control of Motor	Lectures required	References
a	Choppers: Classification of choppers, step-up, step-down chopper, Jones chopper, Morgan chopper, and principle of operation for each method. Chopper control techniques.	04	1 to 5
b	Speed control of single- phase induction motor-using SCR and triac: various methods their circuit diagrams and working.	04	1 to 5

Unit - V

Sr. zNo.	Unit V: Industrial Applications	Lectures required	References
a	Thyristor control Applications: AC and DC Static circuit breaker, Over Voltage protection circuit.	02	2, 4
b	Zero voltage switch, Integral-cycle triggering, Time delay circuit, Soft start circuit.	02	2, 4
c	Temperature regulator, SCR-controlled dimmer circuit, Emergency light using SCR, automatic	01	2, 4
d	Water level indicator, automatic battery charger using SCR.	01	2, 4
e	Ultrasonic and applications	02	2, 4

References:

1. Dr. P.S. Bimbhra, 'Power Electronics', Khanna Publisher.
2. M. Ramamoorty, 'An introduction to Thyristors and their applications', second edition, East-West Press.
3. M.D. Singh and K.B. Khanchandani, 'Power Electronics', Tata McGraw Hall.
4. S.K.Bhattacharya, S.Chatterjee, 'Industrial Electronics and Control' , Tata McGraw-Hill.
5. P.C.Sen, 'Power Electronics', Tata McGraw-Hill.
6. http://nptel.iitm.ac.in

Industrial Management and Economics

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit I: Principles of Management	Lectures required	References
a	Basic Concepts: Definition, Nature, Importance, Management: Art and Science & as a Profession, Management Vs Administration, Evolution of Management: Introduction to Scientific Management by Taylor, Administrative, Management by Fayol, Contribution of Peter Drucker, Levels & Functions of Management, Forms of Business Organization.	03	1 to 5
b	Approaches to Management: Decision Theory Approach, Contingency Approach, Systems Approach.	03	1 to 5
c	Organization: Formal & Informal, Line & Staff relationship, Centralization vs. Decentralization, Span of Management, Departmentation, MBO.	03	1 to 5

Unit - II

Sr.No.	Unit II: Economics	Lectures required	References
a	Introduction: Meaning & Scope of Economics, Basic Theories, Law of Demand & Supply, Elasticity of Demand & Supply.	03	1 to 5
b	Consumer Theories: Meaning of Utility & Law of Diminishing Utility.	03	1 to 5
c	Cost Concepts: Opportunity Costs, Sunk Costs, Marginal Cost, Total & Variable Costs, Fixed Costs, Contribution, Law of Diminishing Return.	02	1 to 5

Unit - III

Sr.No.	Unit III: Economic appraisal techniques	Lectures required	References
a	Economic appraisal techniques: Long- Range and Short r ange Budgeting,	02	1 to 5
b	Criteria for Project Appraisal,	02	1 to 5
c	Social benefit-cost analysis,	02	1 to 5
d	Depreciation: concepts and Techniques	02	1 to 5

Unit – IV

Sr.No.	Unit IV: Marketing Management	Lectures required	References
a	Introduction to Marketing: Concept of Market.	02	6
b	Types of Market, Definition, Nature & Scope of Marketing.	02	6
C	Marketing Approaches, Marketing Process, Functions of Marketing Management.	02	6
d	7 P's of Marketing. Advertising media of advertising market forecasting.	02	6

Unit - V

Sr. No.	Unit V: Financial Management	Lectures required	References
a	Introduction to Financial Management: Meaning, Nature & Scope of Financial Management.	03	7
b	Capital Structure, Types & Sources of Finance.	03	7
c	Money Market & Capital Market, Role of Financial Institutions in Industry.	02	7

Reference Books:

1. O P Khanna, "Industrial Engineering Managements"
2. L.M.Prasad, "Principles of Management", Himalaya Publications Ltd
3. D.N. Dwivedi, "Managerial Economics", Vikas Publications
4. Engineering Economics : Degramo.
5. A Text Book of Economic Theory : Sammuelson
6. Philip Kotler, "Marketing Management", Tata McGraw Hill
7. Ravi M. Kishor, "Financial Management", Taxmann Publication.

Control System Components

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	To control any one process variable in the control loop (Flow, Level, Pressure, Or Temperature) & plot the graph of controlled variable Vs time.	02
2	To plot the characteristics of two-wire transmitter.	02
3	To plot the characteristics of I/P or P/I converter.	02
4	Calibration of DP transmitter for flow/ level interface.	02
5	Tuning of PID controller.	02
6	To plot the characteristics of Control valve.	02
7	Test and find the time constant of a given control valve.	02
8	Study of pneumatic components and simple pneumatic circuits.	02
9	Study of hydraulic components and simple hydraulic circuits.	02
10	Implement various ISA sequence on alarm annunciator.	02
11	To plot the characteristics of synchros / AC servo motor.	02
12	To plot the characteristics of square root extractor.	02
13	To plot the characteristics Pressure switch / Temperature switch.	02
14	Implement ladder diagram for simple Applications on PLC.	02
15	Study of specific/related equipment e.g. RTD, T/C, PH simulator, pressure regulator, safety devices.	02

Note: The term-work should include a minimum of twelve experiments from the above list.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and Practical assignment submitted by the student in the form of journal.

Digital Signal Processing Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Shifting and folding of digital signal.	02
2	Linear convolution.	02
3	Discrete Fourier transforms.	02
4	Fast Fourier transforms.	02
5	Design and implement FIR filter using windowing method.	02
6	Design and implement IIR filter using Butterwoth approximation.	02
7	Design and implement IIR filter using Chebeshev approximation.	02
8	Sine/square wave generation using TMS32OC67XX.	02
9	FIR filter implementation using TMS32OC67XX.	02
10	IIR filter implementation using TMS32OC67XX.	02
11	Filtering Using Discrete Wavelet transforms.	02

Note: The term-work should include a minimum of ten experiments from the above list.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Microcontroller and Application Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Write ALP for addition of 8 bit and 16-bit Numbers using IC 89C51.	02
2	Write ALP for Subtraction of 8 bit and 16-bit Numbers using IC 89C51.	02
3	Write ALP for multiplication of 8 bit and 16-bit Numbers using IC 89C51.	02
4	Write ALP for division of 8 bit and 16-bit Numbers using IC 89C51.	02
5	Write ALP for addition of 8 bit and 16-bit Numbers using IC 89C51.	02
6	Write ALP for 8051 Microcontroller Interfacings with LEDs.	02
7	Write ALP for 8051 Microcontroller Interfacings with DC Motor.	02
8	Write ALP for 8051 Microcontroller Interfacings with Stepper Motor.	02
9	Write ALP for 8051 Microcontroller Interfacings with DAC.	02
10	Write ALP for 8051 Microcontroller Interfacings with ADC.	02
11	Write ALP for 8051 Microcontroller Interfacings with Serial Communication.	02
12	Write ALP for Interfacing with 7-segment Displays	02

Note: Lab file should consist of minimum ten experiments

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Power Electronincs Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Design and plot the characteristics of SCR.	02
2	Design and plot the characteristics of Triac.	02
3	Design and implement different firing circuit for thyristor.	02
4	Design and implement single-phase half wave controlled rectifier.	02
5	Design and implement single-phase full wave controlled rectifier.	02
6	Design and implement different commutation circuits.	02
7	Design and implement series inverter.	02
8	Design and implement parallel inverter.	02
9	Design and implement Single phase Cycloconverter.	02
10	Design and implement step-up chopper.	02
11	Design and implement step-down chopper.	02
12	Design and implement SCR Controlled dimmer circuit.	02
13	Design and implement AC/DC Universal motor speed control using SCR.	
14	Design and implement AC/DC Universal motor speed control using Triac	

Note: Lab file should consist of minimum twelve experiments

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Electronics Workshop (LAB)
(Course Contents)

PCB Design. **14 Hours**

Printed circuit board design guidelines: general components layout scheme, grid system, PCB size mechanical stress, design rules for analog and digital circuit PCB, single, multi layer and SMD boards, Artwork CAD packages, Plating Process, Etching process, PCB Drilling, Soldering techniques.

Electronic Workshop Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Design and Fabrication of PCB (printed circuit boards) using any PCB design software.	02
2	Layout of circuit using standard Layout tool (Orcad / Protel / CADstar / Pads / Ultiboard etc) should be designed and PCB making process should be carried out.	04
3	Study of different tools required in electronic workshop (e.g. striper, cutter, nose pliers, crimping tools, drilling machine, tube bender, pipe cutters, etc.)	02
4	Testing of different electronic components (e.g. resistor, capacitor, inductor, diodes, Transistors, etc).	02
5	Study of different auxiliary electronic/electrical components and different cables (e.g. lugs, ferrules, glands, relays, contractors, Audio/Microphone cables, ribbon cables, data transmission cables, power cables, Fiber optic cables, video/TV cable etc)	04

Note: The term-work should include a minimum of eight assignments and final PCB Manufacturing from the above topics.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and Practical fabrication of PCB which the group of students fabricated and submitted by them.

Industrial Training/EDP/Special Study

Industrial Training	• Student shall undergo industrial training for a minimum period of **two weeks** during summer vacations between fourth semester and fifth semester. • The industry in which industrial training is taken should be a medium or large scale industry • The paper bound report on training must be submitted by the student in the beginning of Fifth semester along with a certificate from the company where the student took training. • Every student should write the report separately. • Institute / Department/T&P Cell have to assist the students for finding Industries for the training. • Students must take prior permission from Department before joining for Industrial Training.
EDP (Entrepreneurship Development Program)	• Student has to participate in Entrepreneurship Development Program for a minimum period of **One week** during summer vacations between fourth semester and fifth semester. • Every student must submit the paper bound report based on the program in the beginning of Fifth semester along with a certificate (Course / Program completion) from the program organizers. • Every student should write the report separately. • Institute / Department may arrange Entrepreneurship Development Program at their campus. • Students must take prior permission from Department before attending any Entrepreneurship Development Program.
Special Study	• Student has to submit name of three topics of his interest to the department. • Special study in a group shall not be allowed. • The three-member committee appointed by Head of Department shall allot one topic out of the three topics submitted by the student. • Every student must submit the paper bound report based on special study at the end of Firth semester. • Department should allot guide to all such students, for monitoring their progress and guide them for literature survey / report writing etc. • Evaluation of special study shall be done based on presentation made by student, followed by brief question answer session.

Evaluation of Industrial Training / EDP / Special Study

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training / EDP / Special study and based on knowledge / skill acquired by the student. The three-member committee appointed by Head of Department shall assess the reports and award marks based on following:

(a) Report	10 marks.
(b) Presentation	10 marks.
(c) Viva-voce at the time of presentation	05 marks.
Total:	**25 marks.**

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Teachers, Paper Setters and Examiners Guideline Manual

for

Third Year Instrumentation Engineering

Faculty of Engineering and Technology

SEMESTER –VI

W.E.F 2014 – 2015

Digital Control System

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Unit-I: Introduction to Discrete-Time Control Systems.	Lectures required	References
a	Introduction to Discrete-Time Control System.	01	1 to 5
b	Basic building blocks of Discrete time Control system.	02	1 to 5
c	Quantization and Quantization Error	02	1 to 5
d	Sampling theorem, Z transform applications for solving differential equations	04	1 to 5

Unit - II

Sr.No.	Unit-II: Z plane Analysis of Discrete-time Control Systems.	Lectures required	References
a	Introduction to Z plane Analysis of Discrete-time Control Systems.	03	1 to 5
b	Impulse Sampling and Data Hold	02	1 to 5
c	Transfer function of Zero Order Hold and First Order Hold.	02	1 to 5
d	Pulse Transfer Function	02	1 to 5

Unit - III

Sr.No.	Unit-III: Design of Discrete Time Control System by conventional methods	Lectures required	References
a	Introduction to Design of Discrete Time Control System by conventional methods	02	1 to 5
b	Mapping between the S plane and Z plane.	02	1 to 5
c	Stability analysis in Z-plane, Jury stability criterion, Bilinear transformations	02	1 to 5
d	Digital Controller Design using Analytical Design Method	02	1 to 5

Unit – IV

Sr.No.	Unit-IV: State Space Analysis of Discrete Time Control System	Lectures required	References
a	State space representation of discrete time systems	02	1 to 5
b	Solution of discrete time state space equations	02	1 to 5
C	Pulse transfer function matrix	02	1 to 5
d	Discretization of continuous time state space equations	02	1 to 5
e	Similarity transformations		

Unit - V

Sr. No.	Unit-V: Pole Placement and Observer Design	Lectures required	References
a	Concept of Controllability and Observability.	02	1 to 5
b	Useful transformations in state space analysis and design	02	1 to 5
c	Stability improvement by state feedback, Design via pole placement, State observers.	01	1 to 5
d	Quadratic Optmal Control	02	1 to 5
e	Stedy-StateQuadratic Optmal Control	01	1 to 5

Reference Books

1. G.F.Franklin, J.David Powell, "Digital control of Dynamic Systems" ,Michael Workman 3rd Edition, Addison Wesley, 2000.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern Ltd, 1989.
3. Kannan Moudgalya, "Digital Control", John Wiley and Sons, 2007.
4. Forsytheand W. and Goodall R.N, " Digital Control" McMillan,1991.
5. Contantine H. Houpis and Gary B. Lamont, "Digital Control Systems", Second Edition, McGraw-Hill International, 2002.
7. http://nptel.iitm.ac.in

Data Communication and Telemetry

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr. No.	Unit I: Elements of communication system	Lectures required	References
a	Need for modulation.	02	1 to 5
b	Amplitude modulation and detection.	01	1 to 5
c	Generation and detection of DSB-SC, SSB and vestigial side band modulation.	02	1 to 5
d	Carrier acquisition	02	1 to 5
e	AM transmitters and receivers	02	1 to 5

Unit - II

Sr. No.	Unit II: Modulation	Lectures required	References
a	Introduction, sampling process	01	1 to 3
b	Pulse width modulation and Pulse Position Modulation.	01	1 to 3
C	Waveform coding Techniques: Discrtization in time and amplitude	02	1 to 3
d	Quantization process, quantization noise.	01	1 to 3
e	Pulse code Modulation, Differential Pulse code Modulation	02	1 to 3
f	Delta Modulation and Adaptive Delta Modulation	02	1 to 5

Unit - III

Sr. No.	Unit III: Digital Modulation Techniques	Lectures required	References
a	Types of digital modulation.	02	1 to 5
b	Waveforms for amplitude, frequency and phase shift keying.	02	1 to 5
c	Methods of generation of coherent and non-coherent.	02	1 to 5
d	ASK, FSK and PSK, comparison of above digital techniques.	02	1 to 5

Unit – IV

Sr. No.	Unit IV: Time Division Multiplexing	Lectures required	References
a	Fundamentals, TDM and FDM	02	1 to 5
b	Introduction to TDMA, FDMA and CDMA.	02	1 to 5
C	Introduction to Information Theory: Measure of information	02	1 to 5

d	Entropy & Information rate, channel capacity	01	1 to 5
e	Hartley Shannan law, Huffman coding, shannan Fano coding.	01	1 to 5

Unit - V

Sr. No.	Unit V: Telemetry	Lectures required	References
a	Introduction to telemetry and telecontrol-telemetry links-telemetry error	02	6
b	Remote Sensor. Classification of signals-their suitability for telemetry	02	6
c	Analog and digital telemetry.	01	6
d	Landline telemetry-mechanical.	01	6
e	Pneumatic and electrical systems – industrial telemetry.	01	6
f	Application of negative feedback for pneumatic and wire telemetry systems.	01	6

Reference Books:

1. Simon Haykin," Communication Systems" John Wiley & Sons 4th Edition
2. G.Kennedy and B. Davis,"Electronic Communication Systems" 4th Edition, Tata McGraw Hill
3. B.P. Lthi, "Modern Analog & Digital Communication Systems" Oxford University Press.
4. Taub & Schilling, "Communication System: Analog and Digital" Tata Mc Graw Hill
5. R.P.Singh & S.D. Sapre, "Communication Systems Analog and Digital" Tata McGraw Hill.
6. Telemetry Principles by Patranabis.
7. http://nptel.iitm.ac.in

Process Instrumentation

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr. No.	Unit I	Lectures required	References
a	Process characteristics: Types of Processes (Dead time, single and multicapacity, Self and non-self regulating, interacting and non-interacting, linear and non-linear processes).	02	1 to 6
b	Process gains, process reaction curve, process time constant and constant step analysis method for finding time constant, Dead time.	04	1 to 6
c	Dynamic elements in control loops. PID control of processes. Process simulators.	03	1 to 6

Unit - II

Sr. No.	Unit II	Lectures required	References
a	Analysis and properties of some common loops: Flow, pressure level, temperature, composition, pH etc.	03	1 to 6
b	Linear and non linear controllers, review of PID with limitations(offset, saturation in D, & reset windup) rate before reset, PID variations, and tuning,	02	1 to 6
c	Digital controller (position and velocity algorithms, effect of sampling time) hardware structures, features and specification.	02	1 to 6
d	Single loop and multiloop controllers and the application programs, Non-linear controller-two state, three state, proportional time, dual mode, optimal switching.	02	1 to 6

Unit - III

Sr. No.	Unit III	Lectures required	References
a	Multi-loop and multivariable process control systems: Feedback, Feed forward Control, cascade control, ratio control, auto selective control, spit range control.	04	1 to 6
b	Predictive control systems and Adaptive control systems.	02	5
c	Interaction and decoupling, Relative gain analysis, procedure to calculate relative gain, and its applications.	02	

Unit – IV

Sr. No.	Unit IV	Lectures required	References
a	Boiler instrumentation and Optimization, boiler equipment safety interlocks,	02	1 to 5
b	Boiler efficiency and dynamics, boiler controls, combustion control, air to fuel ratio control.	02	1 to 5
C	3 element drum level control, steam pressure control, steam temperature control.	01	1 to 5
d	Burner management and control boiler optimization.	01	1 to 5
e	Furnace control of heat exchangers, steam and fired heaters control	01	1 to 5
f	Reboilers, vaporization and condensers	01	1 to 5

Unit - V

Sr. No.	Unit V	Lectures required	References
a	Instrumentation schemes for Pumps and compressor controls.	03	2, 4, 5
b	Instrumentation schemes for multi effect evaporators, dryer, chemical reactors, cooling tower.	03	2, 4, 5
c	Instrumentation schemes for rolling mill, extruder, crystallizer, chiller and ORP control.	02	2, 4, 5

References Books:

1. F. G. Process, “Control Systems”, (TMH)
2. B.G. Liptak , “Process Control,” (Chilton)
3. Krishna kant , “Computer Based Industrial Control”, (PHI)
4. F. G. Shinskey, “Feedback Controllers Tuning, Applications and Designing”, (TMH)
5. Tuning of PID controllers (ISA)
6. G.Stephanopoulos , “Chemical Process Control”, (PHI).
7. Considine “Process Instrumentation and Control Handbook”, (MGH).
8. C. D. Johnson , “Process Control Instrumentation”, (PHI)
9. Continuous process control (ISA)
10. Smart sensors ISA
11. Statistical process Control ISA
12. Multivariable process control ISA
13. http://nptel.iitm.ac.in

Analytical Instrumentation

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr. No.		Lectures required	References
a	**Introduction to classical and instrumental methods for chemical analysis**: comparison of these methods, classification of Instrumental methods (spectral, electroanalytical and separative methods) U.V. Visible and spectroscopy: laws of photometry, Beer and Lambert's law, monochromator design and monochromator performance. Colorimeters, single beam and double beam spectrophotometers, dual wavelength and double monochromatic systems, direct reading multichannel spectrophotometers, diode array rapid scanning spectrophotometers, reverse optics technique.	09	1 to 5

Unit - II

Sr.No.	Unit II:	Lectures required	References
a	**IR spectroscopy**: Instrumentation, sources, detectors, FTIR. Raman Spectrometry; Raman effect, Raman spectrometer components, LASER Raman spectrophotometer.	04	1 to 5
b	**Flame photometry**: Principle, Instrumentation constructional details, fuel gases, atomizer, burner, optical system, Recording system. Interferences in Flame photometry, Applications	03	1 to 5
c	**Atomic Absorption Spectroscopy(AAS**): Principle, instrumentation-hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems. Interferences in AAS, Applications	02	1 to 5

Unit - III

Sr.No.	Unit III:	Lectures required	References
a	**Nuclear Magnetic Resonance (NMR) spectrometry**: Principle ,nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details of NMR spectrometer, sensitivity enhancement techniques, spin decoupler ;Fourier transform NMR Spectroscopy; Electron spin resonance	03	1 to 5

	(ESR) spectrometry – principle, constructional details.		
b	**Fluorimeters and phosphorimeters**; principle, single double beam filter fluorimeter, ratio luorin spectrofluorimeter, microprocessor-bas instrun phosphorescence spectrometer.	03	1 to 5

Unit – IV

Sr. No.	Unit IV:	Lectures required	References
a	**Mass spectrometry**: basic mass spectrometer compor types, magnetic deflection type, time of flight, radio frequ double focusing, quadrupole type ,Gas chromatograph spectro-meter, GCMS Sy stems; resolution of spectrometer, applications.	02	1 to 5
b	**Electron and ion spectroscopy**: surface spectros techniques, electron spectroscopy for chemical analysis (E Auger spectroscopy (AES), Secondary ion mass spectrome (SIMS) and ion scattering Spectroscopy (ISS), densitomete	01	1 to 5
	Radio chemical instrumentation: Radio chemical met radiation detectors – ionization chamber, Geiger M counter, proportional counter, Scintillation cou Semiconductor detectors, pulse height analyzer. spectrometry: X-ray spectrum, instrumentation for spectrometry, X-ray diffract meters, X-ray absorption meter.		

Unit - V

Sr. No.	Unit V:	Lectures required	References
a	**Gas and liquid chromatography**: Classification; basic parts of gas chromatograph – carrier gas, sample injection system, chromatographic column, thermal compartment, temperature programming, dual column system, detectors-thermal conductivity, flame ionization, electron capture, Argon ionization detector, recording instruments; introduction to liquid chromatography and its classification, HPLC , Introduction to optical densitometer, Refractometry.	05	2, 4
b	**Different types of gas analyzers:** oxygen, carbon monoxide, carbon dioxide, Nitrogen analyzer, gas density analyzers. Environment monitoring system.	03	2, 4

Reference Books:

1. R.S. Khandpur, 'Handbook of Analytical instruments', Tata McGraw-Hill.
2. D.Patranabis, 'Principles of Industrial instrumentation', second edition, Tata McGraw-Hill.
3. Willard, Merrit, Eean, 'Instrumental methods of Analysis',
4. E.W.Ewing , 'Instrumental Methods of Chemical Analysis'.
5. Robert D. Braun , 'Introduction to Instrumental Analysis'.
6. B.K.Sharma, 'Instrumental Methods of Chemical Analysis', goyal publications
7. S.G.Skoog , 'Principles of Instrumental Analysis', Thomson.

1. http://nptel.iitm.ac.in

Project Planning & Estimation

Teachers, Paper setters and Examiners should follow the guidelines as given below.

Unit – I

Sr.No.	Introduction	Lectures required	References
a	Definition of Project; Purpose, scope, time, quantity, and organization structure.	02	1 to 5
b	Degree of Automation, Manpower considerations.	02	1 to 5
c	Inter-department and inter organization interactions.	02	1 to 5
d	Process flow sheets, P & I diagrams, Interlock diagrams and Instrument Index Sheets.	01	1 to 5
e	Instrumentation standards and practices, Legends and Symbols, Instrumentation symbols and Identifications (ANSI/ISA-5.1).	01	1 to 5
f	Plant layout, General arrangement drawing (Plans and Elevations).	01	1 to 5

Unit - II

Sr. No.	Unit- II: I & C Documentation and Cable Engineering	Lectures required	References
a	Specification sheets, loop diagrams, ladder diagrams, wiring diagram	02	1 to 5
b	Isometrics, and installation detail drawing, bill of material	02	1 to 5
c	Control panel drawing, instrument data sheet. Document control as per ISA standards.	02	1 to 5
d	Check lists, legend sheets, instrument catalogues, Test and process reports.	01	1 to 5
e	Different classes of conductors and their routines and NEMA Standards.	01	1 to 5
f	Types and specifications of cables, cable schedule, routing of cables, types of glands, ferruling and terminations	01	1 to 5

Unit - III

Sr. No.	Unit- III: Procurement Activities and Construction Activities	Lectures required	References
a	Vendor registration, tendering and bidding process, bid evaluation.	02	1 to 5
b	Purchase order, vendor documents, and drawing and reports as necessary at above activities.	01	1 to 5

c	Site conditions and planning, front availability, Installation and commissioning activities and documents required/generated at this stage	01	1 to 5
d	On-site inspection and testing (SAT) installation sketches, bill of material, contracting, cold commissioning and hot commissioning, CAT (Customer Acceptance Test), Perform trials and final handover.	01	1 to 5
c	Control console, centers, panels and indicators: Types, Design, Inspection, and specification. Intelligent operator interface (IOI).	01	1 to 5
d	Field bus Wiring: Terminator, Power Conditioners, Spurs, Segments, and repeaters.	01	1 to 5
e	Networking: Hubs, routers, LAN cards, and Cat cables	01	1 to 5

Unit – IV

Sr. No.	**Unit- IV: Project Management**	**Lectures required**	**References**
a	Process planning and scheduling.	02	6
b	Management: importance, characteristics, principles and levels of management.	02	6
c	Controlling, Directing, project authority, responsibility, Accountability, interpersonal influences and standard communication format, project Reviews.	01	6
d	The statement of work (SOW), Project specifications, milestone schedules, work breakdown structures, cost breakdown structure and the planning cycle.	01	6
e	Overview planning and execution mode (conceptual focus, design, implementation, operation and support transition).	02	6

Unit - V

Sr. No.	**Unit- V: Cost Management, PERT and CPM**	**Lectures required**	**References**
a	Cost and Estimation: Types of Estimates, pricing process, salary overheads, labour hours, material and support costs.	03	6
b	Network fundamentals, slack time network planning, estimating activity time and total program time.	02	6
c	Total PERT and CPM planning, crash times.	02	6
d	Software used in project management, software features and classification evaluation and implementation.	01	6

References:

1. Andrew and Williams , "Applied Instrumentation in Process Industries",Gulf Publishing.
2. Liptak , "Process Control Instruments Engineer's Handbook", Chilton.
3. Hardlod Kerzner, "Project Management System Approach To Planning Scheduling and Controlling, 5th edition, Van Nostrand Reinhold Publishing.
4. John Bacon, " Management systems," (ISA).
5. T.G. Fisher, "Batch Control Systems", (ISA).
6. John Bacon, "Instrument installation project management", (ISA).

Digital Control System Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Find the Response of the Discrete Time Control System for any two standard inputs.	02
2	State Transition Matrix	02
3	Conversion of Continuous Time to Discrete Time Systems	02
4	Transient response of Control System.	02
5	State Space Analysis of Control Systems.	02
6	Pulse Transfer Function.	02
7	Discretization of continuous time state equation.	02
8	Investigation of the controllability and Observability of a system.	02
9	Design of control system using pole placement technique.	02
10	Design of State observer.	02
11	Design of Discrete Time Control System based on minimization of quadratic performance index.	02

Note: Perform experiments using MATLAB . Lab file should consist of minimum Eight experiments

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Process Instrumentation Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Find the time constant of single capacity / Multi-capacity process by graphical methods.	02
2	Study of interacting and non-interacting process.	02
3	Study the analysis of flow / level /pressure control loop.	02
4	Study of temperature control loop	02
5	Tuning the PID controller for any one control loop.	02
6	Implementation of cascade controller.	02
7	Design and implementation ratio controller	02
8	Study of Ratio control/ Selective control	02
9	Study of non linear control elements.	02

Note: Lab file should consist of minimum eight experiments

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by students in oral examination.

Analytical Instrumentation Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	Study of filter photometer.	02
2	Study of flame photometer.	02
3	Study of Densitometer.	02
4	Study of spectrophotometer (visible and infra-red region)	02
5	Study of single beam spectrophotometer for UV/VIS range.	02
6	Study of double beam spectrophotometer for UV/VIS range.	02
7	Study of mass spectrometers.	02
8	Study of gas chromatographs.	02
9	Study of liquid chromatographs.	02
10	Study of N.M.R. and E.S.R. spectrometer.	02
11	Study of atomic absorption spectrophotometer.	02
12	Study of Refractometer.	

Note: Lab file should consist of minimum ten experiments

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Virtual Instrumentation Lab

(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

S.N.	Lab Experiment	Hours required
1	To study programming for virtual instrument Using LabVIEW	02
2	Develop a LabVIEW program for conversion • Degree Celsius to Fahrenheit • Degree Celsius to Kelvin • Degree Celsius to Rankin	02
3	Implementation of Full Adder using LabVIEW	02
4	To generate 'n' random number using for loop and show it on graph	02
5	To develop a LabView program for creating function generator for variable with variable Amplitude, Frequency and Phase.	02
6	To Develop a LabView program for Addition of i. Array with Array ii. Array with Number iii. Cluster with Number	02
7	Develop a LabVIEW program for addition of i. Matrix with Matrix	02
8	Waveform with Number Develop a LabView program using case structure	02
9	Develop a LabVIEW program for Amplitude, Phase and Frequency measurement.	02
10	To Integrate and use Hardware compatible with LabVIEW like DAQ Cards, NI ELVIS Board etc.	02
11	Develop a LabVIEW based Temperature Measurement and Control System.	02
12	Develop a LabVIEW based Temperature Measurement and Control System.	

Note: Lab file should consist of minimum ten experiments

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work , performance and oral in the practical examination.

Minor Project

1	Every student shall undertake the Minor Project in semester VI. It is expected that the broad area of major project shall be finalized by the student in the beginning of the VI semester and Minor project undertaken may be a part of Major Project.
2	Each student shall work on an approved project, a group of **04 students (maximum)** shall be allotted for the each minor project and same group may be continued for major project.
3	Minor project may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.
4	Each student is required to maintain separate log book for documenting various activities of minor project.
5	The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of minor project. Maximum four minor project groups shall be assigned to one teaching staff.

Guide lines for ICA : Assessment of the project for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Assessment of Minor Project

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Exam Seat No	Name of Student	Project Selection	Documentation	Design /Simulation/Logic	PCB/hardware/programming	Result Verification	Presentation	Total
			5	10	10	10	10	5	50

Seminar-I

1	For Seminar-I every student will individually study a topic assigned to him / her and submit a report and shall deliver a short lecture / Seminar on the topic during the term.
2	The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-I. Seminar shall be related state of the art topic of his choice approved by the committee.
3	Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
4	Topic of Seminar shall be registered within a two week from commencement of VI Semester and shall be approved by the committee.
5	Maximum six seminar supervision shall be allotted to each teacher.
6	At the end of semester, student should submit the seminar report (paper bound copy)in following format: a. Size of report shall be of minimum 25 pages. b. Student should preferably refer minimum five reference books / magazines/standard research papers. c. Format of report i. Introduction. ii. Literature survey. iii. Theory 1) Implementation 2) Methodology 3) Application 4) Advantages, Disadvantages. iv. Future scope. v. Conclusion.

ASSESSMENT OF SEMINAR-I

Guide lines for ICA : Assessment of the Seminar-I for award of ICA marks shall be done by the guide and a departmental committee jointly, as per the guidelines given in **Table- B**

Title of Seminar: _____

Name of Guide: _____

Table-B

SN	Exam Seat No	Name of Student	Topic Selection	Literature survey	Report writing	Depth of understanding	Presentation	Total
			5	5	5	5	5	25