SHIVAJI UNIVERSITY, KOLHAPUR

SYLLIBUS/ STRUCTURE (REVISED from June- 2009)
T.E. Instrumentation (Sem. – V)

Sr. No.	NAME OF THE SUBJECT	TEACHING SCHEME (Hr)				EXAMINATION SCHEME (Marks)				
---	---	L	T	P	TOTAL	THEORY	TW.	POE	ORAL	TOTAL
1	FIBER OPTICS & COMMUNICATION	4	--	2	6	100	25	---	25	150
2	ADVANCED CONTROL SYSTEMS	4	--	2	6	100	50	---	---	150
3	INDUSTRIAL POWER ELECTRONICS	3	1	2	6	100	50	50	---	200
4	UNIT OPERATION	3	--	--	3	100	--	---	---	100
5	ANALYTICAL INSTRUMENTATION	3	--	2	5	100	25	---	25	150
6	MATLAB PROGRAMMING	3	--	2	5	---	50	---	---	50
---	**TOTAL**	**20**	**1**	**10**	**31**	**500**	**200**	**50**	**50**	**800**

T.E. (INSTRUMENTATION) Sem.-VI

Sr. No.	NAME OF THE SUBJECT	TEACHING SCHEME (Hr)				EXAMINATION SCHEME (Marks)				
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1	MICROCONTROLLERS & APPLICATIONS	3	--	2	5	100	25	50	---	175
2	INDUSTRIAL AUTOMATION - I	4	--	2	6	100	25	---	25	150
3	PROCESS CONTROL	3	1	2	6	100	50	---	25	175
4	SIGNALS & SYSTEMS	3	--	--	3	100	--	---	---	100
5	INDUSTRIAL MANAGEMENT	3	--	---	3	100	--	---	---	100
6	SOFT SKILLS	1	--	2	3	---	50	---	---	50
7	VISUAL BASIC & LAB VIEW	3		2	5	---	50	---	---	50
---	**TOTAL**	**20**	**1**	**10**	**31**	**500**	**200**	**50**	**50**	**800**

Students must undergo Industrial Training for at least 3 weeks in summer vacation and submit the report in standard format in next semester(B.E. Part – I) for assessment.

Sem. – V (I)

FIBER OPTICS & COMMUNICATION

Teaching Scheme	Examination Scheme
Lectures : 4 Hrs / week	Theory :- 100 Marks
Practicals : - 2 Hrs / week	Term work :- 25 Marks
	Oral : 25 Marks

1) **Introduction to Optical Fiber Communitation : 4 Hrs**
Elements of an Optical Fiber Transmission link., Optical Fiber modes, and configurations, Single mode fibers, Fiber materials, Fiber fabrication.

2) **OPTICAL SOURCES 4 Hrs**
Topics from Semiconductor Physics, Light Emitting Diodes, Laser Diodes, Light source linearity, Reliability considerations.

3) **POWER LAUNCHING & COUPLING : 4 Hrs**
Sources to Fiber power launching, Lensing schemes for coupling improvement, Fiber to fiber joints, LED coupling to single mode fibers, Fiber splicing, Optical Fiber connectors.

4) **PHOTODETECTOR :** 5 **Hrs**
Physical principles of photo diodes, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain.

5) **WDM Concepts & Components :** 5 **Hrs**
Operational principle of WDM, Passive components, Tunable sources, Tunable filters,

6) **OPTICAL NETWORKS : 5 Hrs**
Basic networks, SONET / SDH, Broadcast and select WDM networks, Wave length routed networks, Non linear effects on network performance, Performance of WDM +EDFA systems, Optical CDMA, Ultra high capacity networks.

7) **MEASUREMENTS APPLICATIONS : 6 Hrs**
Measurement Standards & Test Procedure Test equipments, Attenuation measurement, Dispersion measurement, Distance measurement, Flow measurement, Level measurement, Pressure and Vibration measurement, Endoscopy, Holography.

8) **REMOTE SENSING : 7 Hrs**

Parameters of a Sensors, Definition : Components of Remote sensing – Energy, sensor, interacting Body, Active & passive Remote sensing – platforms—Aerial & space platforms--Balloons, Helicopter, Aircraft & satellites – synoptivity and Repetivity--Electro Magnetic Radiation (EMR) - EMR spectrum--visible, Infra Red
(IR), Near IR, Middle IR, Thermal IR & Microwave-Black body radiation--plank's Law- Stefan-Boltzman Law.

Recommended Books :

1) Opto Electronics – An Introduction, J.Wilson J.F.B.Hawkes, Prentice Hall of India New Delhi. 1996
2) Integrated circuits and semiconductor devices theory and application- Deboo Burrous ,McGraw Hill Second Edition.
3) Optical fiber communications principles and practice , J.M. senior Prentice Hall of India , Second Edition 1996
4) Fiber optics - communication and other application, H. Zanger and C.Zanger McGraw Pub
5) Fiber optics - communication , Gerd Keiser.
6) Optical fiber systems, Tecnology, Design & Application .- Kao C.K McGraw Hill
7) Introduction to optical fibers, Cherin, McGraw Hill
8) Text book on optical fiber Communication & it's application S.C.Gupta (PHI)
9) Basics of Remote Sensing & GIS, By: Dr. S. Kumar (Laxmi publications)

Suggested Laboratory Experiments

1) To plot spectral response characteristics of photodiode
2) To plot spectral response characteristics of photo transistor
3) To plot intensity response of photo diode
4) To plot intensity response of phototransistor.
5) Study of Fiber optic communication trainer kit.
6) Numerical aperture measurement of optical fiber.
7) Displace measurement by fiber optic
8) Data communication by fiber optic
9) Characteristics of opto coupler

Students are expected to perform minimum six experiments based on above topics

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Sem. – V (I I)

ADVANCED CONTROL SYSTEMS :

Teaching Scheme	Examination Scheme
Lectures : 4 hrs / week	Theory paper : 100 Mark
Practical : 2 hrs / week	Term work : 50 Mark

1) NONLINEAR SYSTEMS : 5 HRS

Types of non – linearities, analysis by describing functions method , phase plane method, construction of trajectories by isocline method .

2) STATE SPACE REPRESENTATIONS OF CONTINUOUS TIME SYSTEM 10 HRS

Definitions of state variable , state, state vector, state space, state trajectory. Multi input –multi output system state model and block diagram. SISO System State Model & block diagram. Obtaining transfer function from state-space model. Determination of state transition matrix, properties of state transition matrix. Solution of homogeneous and non homogeneous state equations. Concepts of controllability and observability.

3) DESIGN OF CONTINUOUS –TIME SYSTEM IN STATE- SPACE 06 HRS

Introduction , Pole placement , solving pole-placement problems, Ackerman's formula, state observers, observer design.

4) DISCRETE –TIME CONTROL SYSTEM 08 HRS

Introduction of discrete time system. Review of Z-transform, Z- plane analysis of discreet time control system. Pulse transfer function, Impulse sampling, Laplace transform of impulse sampled single starred Laplace transform of signal involving both ordinary and starred Laplace transforms, Block diagram analysis,

5) STABILITY OF DISCRETE –TIME SYSTEM :- 5 HRS

Introduction, equivalence between 'Z' domain and S- domain. Stability analysis by Jury test and bilinear transformation with Routh criterion

6) STATE-SPACE REPRESENTATION OF DISCRETE –TIME CONTROL SYSTEM :- 08 HRS

Introduction, state space representation of discrete time control system. Solving discrete time- state space equations by recursion method & Z-transform method. State transition matrix by Z-transform and Cayley Hamilton method. Realization of pulse transfer function by direct programming method.

7) DESIGN OF DISCRETE –TIME CONTROL SYSTEM IN STATE –SPACE :- 05 HRS

Controllability, Observability, Kalman's test for controllability and observability. Design via pole placement and observer.

Termwork :- The termwork shall consist of at least ten assignments / tutorials /MATLAB programs based on above syllabus.

Suggested Books

1) Modern Control Engineering – K . ogata , PHI Publication.
2) Discrete –time control systems - K . ogata , Fourth Edition 2002
3) Control Systems engineering – R. Anandnatarajan / P. Rameshbabu.(Scientech)
4) Modern Control System Theory – M. Gopal
5) Control Systems engineering – I.J.Nagrath and M Gopal.
6) Digital Control & stak variable methods, by M Gopal – McGraw Hill Publication
7) Control Theory – Multivariable & nonlinear methos by Torkel Glad & Lennant Ljund Vikas Publication House.
8) Computational aids in control systems using MATLAB– Hadi Saadat

Note : The MATLAB coverage is limited only for practical No theory questions will be asked on MATLAB.

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Sem. – V (3)

INDUSTRIAL POWER ELECTRONICS

Teaching Scheme	Examination Scheme
Lectures :- 3 Hrs / week	Theory Paper – 100 Marks
Tutorial:-1Hour/Week	Term work - 50 Marks
Practicals : -2 Hrs / week	POE - 50 Marks

1) STUDY OF POWER ELECTRONICS DEVICES 6 Hrs.

SCR with turn on /off methods, MOSFET (with drive circuit), IGBT, Diac, Triac, Ratings and its protection circuits,

2) Phase controlled Rectifiers : 4 hrs

Single phase controlled rectifiers : Half wave, center tapped Bridge (half controlled and fully controlled) with R and R-L load (calculation of performance parameter), with continuous and discontinuous current mode of operation.

3) DC. CHOPPER & AC. CHOPPER 4 Hrs.

Basic chopper, Step up chopper, Step down chopper, Series turn off chopper,
Morgan chopper, Jones chopper, AC.chopper : Principle and ON/OFF control, Single phase Bi-directional control of inductifve load,

4) Inverters : 6 hrs

Transistorized half bridge & full bridge inverter, Series inverter, Parallel inverter with R and RL load. Voltage control technique of Single Phase inverter, Harmonic reduction techniq.

5) DC MOTOR & AC MOTOR CONTROL 6 Hrs.

Scheme for DC motor speed control, Single phase separately excited drives. Braking operation of rectifier controlled separately excited motor. Single phase series DC motor drives, Speed control of induction motor. Stator voltage control variable frequency control, Rotor resistance control.

6) INDUSTRIAL CIRCUITS & ITS APPLICATION 8 HRS

UPS online, off line (block diagram) , Servo Stabilizer (block diagram), SMPS, (Buck regulated, Boost regulated, Line voltage fly back converter), Emergency light, battery charger using SCR, AC power flasher, DC power flasher, DC timer circuit using UJT and SCR.

7) CYCLO CONVERTERS : 2 Hrs

Single phase to single phase , Mid point bridge type, Continuous current mode and discontinuous current mode of operation.

Suggested books:

1) M.H. Rashid , power electronics, PHI India .
2) P.C sen, power electronics, TMH India.
3) SCR Manual
4) Power Electronics. : M.D. Khandchandani (MGH)

Suggested Laboratory Experiments

1) To study SCR Characteristics.Also calculate Values of holding and latching current
2) To study Diac / Triac Characteristics. Also calculate Break over voltage of diac
3) To study different turn on Methods of SCR
   1)R-C 2)UJT
4) To study different turn off Methods of SCR (Class A to Class E) any one
5) To study single phase full controlled Rechfier with R and R-L Load (with and without Free wheeling diode)
6) To study single phase half controlled Rechfier (Semi converter) with R and R-L Load
   (with and without Free wheeling diode)
7) To study series inverter Draw and observe voltage waveforms across RLC, R-L and pure resistive Load.
8) To study paralled inverter. Find out efficiency at constant load
9) To study Morgon chopper Plot graph of V Load Vs dutycycle at constant load.
10) To study D.C. power flasher using SCR.
11) To study single phase cyclo converter
12) To study speed control of d.c. Motor using SCR

Note :- Students are expected to perform minimum 8 experiments

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Sem. – V (4)

UNIT OPERATIONS

Teaching scheme :
Lecture Scheme : 3 hrs / per week

Examination scheme:
Theory : 100 marks

1 INTRODUCTION : - 3 hrs

Basic concepts of unit operations and unit processes, Material Balance – Energy Balance, Batch and continuous process – operations, endothermic and exothermic reactions

2 MECHANICAL OPERATIONS: - 6 hrs

2.1 Size Reduction : Theory and Principles in crushing and grinding Equipments used : Jaw crusher , Crushing Rolls, Hammer Mill, Ball Mill.
2.2 Size separation : capacity and screen effectiveness, ideal and actual screens, Equipments : Trommels , Gravity setting tank, Magnetic and Electrostatic separator. Sedimentation, Cyclone Separator
2.3 Filtration : Principle , type of filtration ,constant pressure and constant rate filtration . Equipments : Rotary drum filter, centrifuge.

3 HEAT TRANSFER : - 6 hrs

3.1 Basic modes of heat transfer, Basic Laws and equations to calculate Heat transfer rates
3.2 Heat transfer Equipments : Double pipe heat exchanger. shell and tube heat exchanger. Types of shell and tube exchanger.
3.3 Evaporation , Types of evaporators , multiple effect evaporators. Methods of feeding multiple effect evaporation.
3.4 Control systems for heat exchanger and evaporators .

4 DISTILLATION : 6 hrs

4.1 Concept of distillation , Boiling point diagram, Roult's Law, Vapour liquid equilibrium, Volatility , constant boiling mixtures azeotrope.
4.2 Methods of distillation, importance of reflux ratio.
4.3 Fractional distillation
4.4 Control system for fractionating column .

5 ABSORPTION : 3 hrs

5.1 Concept of absorption and adsorption , concept of equilibrium ,
5.2 Gas absorption Equipments, pressure drop across column, Tower packings
5.3 Control system for packed absorption column .

6 EXTRACTIONS : 3 hrs

6.1 General consideration of extraction , equilibrium condition , ternary system , 'basic properties of solvent.
6.2 Extraction Equipments : mixer settler , spray column
6.3 Control system for spray column.

7 CRYSTALLIZATION: 3 hrs

7.1 Concept of crystallization , saturation and super saturation , Effects of temperature on solubility , methods of super saturation.
7.2 Crystallizers : Agitated tank crystallizer, Swenson –walker crystallizer.
7.3 Control system for Agitated tank crystallizer

8 DRYING : 3 hrs

8.1 Principles, equilibria, Bound & unbound moisture, Rate of drying.
8.2 Drying equipments : Tray drier , Rotary drum drier, Vacuum drier , fluidized bed drier
8.3 Control system for tray drier.

9 MANUFACTURING PROCESSES : 6 hrs

9.1 Manufacturing Process & control of Iron and steels, cement , sulphuric acid , urea, ethanol , Give simple process.

Suggested Books :

1 Mccabe and Smith - Unit operations of chemical Engineering .
2 M gopal Rao and Mgrshall Sitting : Dryden's Outline of chemical technology .
3 Georget Austin - Shreve's chemical process industries .
4 Rober E. Trebal - Mass Transfer operations.
5 Richardson and Colsun - Chemical Engineering Vol. I & II
6 Perry's (6^{th} Edn) - Chemical engineering Handbook .
7 Liptak Bela – Process Control Handbook.
8 Peter Harriot – Automatic Process Control
9 Andrew William – Vol I /II.
10 Mass Transfer Operation :- Rober E. Trebal.

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Sem. – V (5)

ANALYTICAL INSTRUMENTATION

Teaching Scheme	Examination Scheme
Lectures :- 3 Hrs/ week	Therory Paper :- 100 Marks
Practical :- 2 Hrs /week	Termwork : - 25 Marks
	Oral : 25 Marks

OBJECTIVES :

1) To understand basic priciples of various Analytical Instruments.
2) To understand Instrumentation required for different types of Analytical Instruments
3) To know the typical clinical and industrial applications of Analytical Instruments.

1 UNIT – 1 8 Hrs.

Introduction to Chemincal Instrumental Analysis, advantages over classical methods, classification : Spectral, electyroanalytical and seperative methods, Laws of photometry (Beer and Lambart's Law) , Basic components of Analytical Instruments.

2 UNIT – 2 8 Hrs.

Colorimeter, Spectrophotometer (UV-Visible), Monochrometer, Filters, Grating, Prism, Dual wave length and Monochrometor system, Rapid scanning spectrophotometers,IR spectrophotometers,

3 UNIT – 3 8 Hrs.

Flame photometry: Principle, Construction details, Flue gases, Atomizer, Burner, Optical system, Recording system.

Atomic absorption spectrophotometers : Theoretical concepts, Instrumentation : Hollow cathode lamps, Burners and flames, Plasma excitation sources, Optical and electronic system.

4 UNIT – 4 8 Hrs.

Industrial gas analyzers, pH, conductivity, particle counting, detection on the basis of scattering – Nephalomete,

Laboratory Instruments : Centrifuge, oven, water bath, incubators, stirrers, densitometer,

5 UNIT – 5 8 Hrs.

NMR Nuclear Magnetic Resonance spectroscopy, basic principles, continuous wave NMR spectrometers, pulse FT NMR, spectrometer, spectra and molecular structure.

6 UNIT – 6 8 Hrs.

Mass spectrometer (MS) : Principle, ionization methods, mass analyzer types – magnetic deflection type time of flight, quadruple, double focusing, detectors for MS, applications.

X-Ray spectrometry : Instrumentation for X-Ray spectrometry,
X-Ray diffractometer,

7 UNIT – 7 8 Hrs.

Chromatography : Classification,
Gas chromatography: Principle, constructional detail, GC detectors Liquid Chromatography
High Performance Liquid Chromatography (HPLC) : Principle, constructional detail, HPLC detectors

Suggested Experiment :

1) Study of filter photometer.
2) Study of flame photometer.
3) Study of Densitometer.
4) Study of Spectrophotometer (visible and infra –red region)
5) Study of single beam spectrophotometer for U.V./ VIS range.
6) Study of double beam spectrophotometer for U.V./ VIS range.
7) Study of Mass spectrometers.
8) Study of gas chromatographs.
9) Study of liquid chromatographs.
10) Study of N.M.R. spectrometer
11) Study of atomic absorption spectrophotometer

Note : Students are expected to perform minimum 8 experiments.

Suggested books:

1) Instrumental Methods of Analysis 7th edition : by Willard , Merrit, Dean Settle, CBS Publishers & distributors, New Delhi .

2) Handbook of Analytical Instrumentation by R.S.Khandpur (TMH)

3) Principles of Instrumental Analysis 5 th edition By: Skoog, Holler, Nieman, Thomson Books Publications.

Reference books :

1) Instrumental Methods of Chemical Analysis 5 TH edition By; Galen W. Ewing (TMH).
2) Introduction to Instrumental Analysis By : Robert D. Braun (TMH)
3) Instrumental Methods of Chemical Analysis By : Chatwal & Anand

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Sem. – V (6)

MATLAB PROGRAMMING

Teaching Scheme:-
Lectures :- 3 hrs /week
Practicals :- 2 hrs /week

Examination Scheme :-

Termwork :- 50 Marks

1 UNIT – I 2 Hr.s

Introduction ot MATLAB, Desktop tool and development environment : Command window, Command history window, Documents window, Editor de-bugger , fig. window, workspace browser, Help and Path browser, GettingHelp : Help, helpwin, Help desk, lookfor.

2 UNIT – I I 5 Hrs.

Variables : Local & Global, Arrays, Initializing variables, MATLAB operators: Arithmetic, Relational, Logical, multi dimensional Arrays, Subscripting and Indexing (Sub arrays), Displaying O/p data, Scale and array operations, built in functions for handling arrays, Numeric data types, Sparse matrices, Matrix method for linear equation, Polynomial operations using arrays, Cell array and structure arrays,

3 UNIT – I I I 4 Hrs.

MATLAB Programming : Script files, Function files, Braches : If –else, Switch –case and try / catch, Loops : While, For, Break / Continue and nesting loops, user defined functions, function function, sub functions and function handling.

4 UNIT – I V 4 Hrs.

MATLAB Graphics : Two dimensional continuous plots, Discreet plots, Multiple polts in same fig. window using sub plots, Multiple graphs in same plots using hold ON and hold OFF commands, Formatting Plots : X labels, Y labels, title, text, g text, Legend, axis, Handle graphics, 3-D plots, Bar graphs, Histograms, Polar plots, PIC plot.

5 UNIT – V 2 Hrs.

Graphical User interface : Introduction, GUI components, Creating GUI with guide, Creating GUI with Programmatically.

6 UNIT – VI 2 Hrs.

Simulink : Introduction, Creating models, working with blocks, running simulation, creating sub system, Masking sub system.

Suggested Books :

1) S.J. Chapman : MATLAB programming for Engineers, 3/E cengage Learning
2) Duane Hanselman, Bruce Little field, MASTERING MATLAB – 7, Pearson Education LPE
3) William J. Palm – III INTRODUCTION TO MATLAB 7.4 (TMH) -for Unit 2 & 3

Reference Books :

1) Amos Gilat : MATLAB " AN INTRODUCTION WITH APPLICATIONS ", Wiley publication

2) Documentation from www.Mathworks.com

3) File exchange from www. matlabcentral.com

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Sem. – VI (1)

MICROCONTROLLERS AND APPLICATIONS

Teaching Scheme	Examination Scheme
Lectures :- 3 Hrs/ week	Theory Paper :- 100 Marks
Practicals :- 2 Hrs / week	Term work :- 25 Marks
	POE :- 50 Marks

1) INTRODUCTION TO MICROCONTROLLERS : 4 hrs

MCS-51 family architecture, Prog. & data memory organization. SFR and their function. Clock and oscillator, reset organization, power ON reset circuit and its design., external memory and I/P interface like 8255.

2) PROGRAMMING MCS- 51: 8 hrs

Addressing mode, instruction format, instruction types, instruction sets. Assembling Language Programming.

3) 8051 – ON CHIP RESOURCES : 8 hrs

Interrupts structures, timer / counter operation. Serial port operation (modes of operation) multi processor communication.

4) 8051 C PROGRAMMING : 6 hrs

Introduction, Adv/Disadvantage of 8051-C programming. Data types, memory types and models, Arrays, structures, pointers, functions.

5) HARDWARE INTERFACING WITH MCS-51 : 6 hrs

LCD interface, buzzer interface, key pad interface, 4 digit thumbwheel and multiplex display interface, ADC, DAC, PWM interface, sensor interfaces like –Temperature, Pressure, Speed, displacement sensors, through to MCS-51

6) BUS INTERFACE TO MCS- 51 : 4 hrs

RS-232 C interface, EA standards, I^2C interface, SPI Interface, USB interface, CAN interface, Ethernet.

Suggested Books :

1 The 8051 Microcontroller 4th Edition – Scotmackenzis RCW Phan
2 The 8051 Microcontroller 3th Edition – Ayala
3) The 8051 Microcontroller and Embedded Using assembly and C: Mazidi & Mazidi
4) Intel data sheet : MCS-51

Termwork : Consists of Minimum 10 Hardware experiment including 1 Mini Project based on any one application.

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Sem. – VI (2)

INDUSTRIAL AUTOMATION – I

Teaching Scheme	Examination
Lectures: 4 hrs/ Week	Theory Paper – 100 marks
Practical: 2 hrs / Week	Term Work - 25 marks
	Oral - 25 marks

1. **Introduction to Automation: 8 Hrs**
   Evolution & Aims of Industrial Automation. Standard Hierarchical Automation Systems Levels, Functional Levels & Database Organization.
   Features & requirements of manufacturing automation & process automation. Automation options - DCS, PLC, PC, Fieldbus & hybrid architectures. Comparison & selection from among these systems.
2. **PLC Basics 8 Hrs**
   Introduction: Families, Processors, operation, Programming tools, memory structure, access & programming modes. IEC 61131 standards.
   Hardware: Physical components, racks, slot, Power, CPU, Discrete & Analog Input/Output modules, RTUs & HMI panels
   Programming: Numbering systems, Ladder Logic Symbols, basic Instructions, Program Logic Development, testing & debugging. Simple problem solving.
3. **Advanced Techniques 6 Hrs**
   Programming Language Standards IEC 61131-3: IL, ST, SFC, FBD, LL
   Programming: Multi Rung Ladders, Sequence, Logic, transfer of control timers & counters.
   Process Interfacing: Discrete Sensors & Actuators, Analog Sensors & Actuators, Linear & Rotary Encoders.
4. **PLC in Manufacturing Automation 4 Hrs**
   Programming: Logic Development steps, Failsafe Programming, Emergency shutdown, Safety Interlocks
   Case Studies: AC & DC Motor Controls, Variable speed AC motor drives, conveyers, hoist, robots, CNCs.
5. **PLC in Process Automation 6 Hrs**
   Programming: Logic Development steps
   Control strategies: Auto/Manual, Open loop, Closed loop, On-Off.
   Case Studies: Temperature, Level, Pressure & flow control, Continuous & Batch processing.
6. **Commissioning & Maintenance 4 Hrs**
   Project: Planning, Installing & Verifying Project, Project & Program Documentation.

PLC Fault Handling & Diagnostics, Redundant configurations, networking.

7. SCADA **6 Hrs**

SCADA based plant monitoring & control concepts. Functions of SCADA, PLC/SCADA Communication, Graphics & HMI, Animation, Database configuration, Real-Time & historical trends.

Suggested Laboratory Experiments:

Practical will consist of at least 5 experiments each on chapters 2 & 3, and at least 2 experiments each on chapters 4, 5, 6 & 7.

Reference Books:

1. Distributed computer control for Industrial Automation, Popovic & Bhatkar
2. Programmable Logic Controllers, Webb & Reis, PHI
3. Programmable Logic Controllers, John & Fredric Hackworth, Pearson
4. Introduction to Programmable Logic Controllers, Gary Dunning, Thomson
5. SCADA : Supervisory Control And Data Acquisition By : Stuart Boyer ISA

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Sem. – VI (3)

PROCESS CONTROL

Teaching Scheme :	Examination Scheme
Lecture : 3 Hrs / per week	Theroy : 100 Marks
Tutorial:- 1 Hour/Week	Termwork : 50 Marks
Practical : 2 Hrs / per week	Oral : 25 Marks

1) UNIT – I **8 Hrs**

Process characteristics : Types of process (dead time, Single and multi capacity, self and non self regulating, Interacting and non interacting, linear and non linear process) Process gains, process reaction curves, process time constant and constant step analysis method for finding time constant, dead time. Dynamic element in control loops. PID control of process. Process simulators.

2) UNIT – I I **8 HRS**

Analysis and properties of some common loops: Flow, Pressure, Level, Temperature composition, pH etc Linear and non linear controllers, review of PID with limitations
(Offset, saturation in D and reset windup) Rate before reset, PID variation and tuning.

3) UNIT – I I I **8 Hrs.**

Multi loop and multi variable process control systems : Feed back, feed forward control, cascade control, ratio control, auto selective control, split range control, Predictive control systems and Adaptive control system.
(Interaction and de coupling, relative gain analysis, procedure to calculate relative gain and its applications)

4) UNIT - IV **6 Hrs**

Boiler controls : Introduction, drum level, Shrink and Swell effect, Combustion control, Furnace draft control, Steam pressure control, Steam Temperature control, Burner management system (Boiler safety interlocks) Fired heaters : Temperature control

5) UNIT – V **6 Hrs**

Instrumentation scheme for Pumps and Compressor controls, Multi effect evaporators, Drier, chemical reactors, cooling towers, rolling mill, extruder, crystallizer, chiller, advanced pH control.

References Books :

1) Process Control Systems – F.G.Shinskey (TMH)
2) Process Control – B.G. Liptak (Chitlon)
3) Computer based Industrial Control – Krishna Kant (PHI)
4) Feedback Controller Tuning, Application and Design – F.G.Shinsky (TMH)
5) Instrumentation for Process Measurement and Control By : Nirman Anderson, (Chilton)
6) Tuning PID controller (ISA)
7) Chemical Process control – G. Stephanopoulos. (PHI)
8) Process Instrumentation and Control Hand book – Considine.(MGH)
9) Process control instrumentation – C.D. Johnson (PHI)
10) Continuous Process Control (ISA)
11) Smart Senosr (ISA)
12) Statistical Process Control (ISA)
13) Multivariable Process Control (ISA)

Suggested Laboratory Practical:

1) Find the time constant of Single capacity/ Multi capacity process by graphical methods.
2) Study of On / Off control
3) Study of steady state & transient response for single mode, two modes & three mode for typical applications. (Flow,Level,Temperature,Pressure)
4) Study of tuning of PID controller by open loop method & closed loop method using Ziegler – Nichols tuning rules.
5) Study of interacting and non interacting process.
6) Study and analysis of flow / level / pressure control loop
7) Implementation of cascade controller
8) Design and implementation of ratio controller

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Sem. – VI (4)

SIGNALS AND SYSTEMS

Teaching scheme :
Lecture Scheme : 3 hrs / per week

Examination scheme:
Theory : 100 marks

1 SIGNALS AND SYSTEMS 6 Hrs.

SIGNALS :- Definition, CT signals, DT signals and their representation, elementary types CT & DT signals, power signals, energy signals, Transformation of independent variable

SYSTEMS : Definition, Types of systems, Interconnection, Properties of CT & DT systems.

2 TIME DOMAIN ANALYSIS OF LTI SYSTEMS 8 Hrs.

DTLTI System :- DTLTI system defined by difference equation, Time domain response of system : Natural, Forced, Impulse response, representation of signals in terms of impulses, convolution, sum.

CTLTI System :- CTLTI system defined by differential equation, Time domain Response, of system : Natural, Forced, representation of C.T. signals, convolution integral, properties of convolution integral

3 FOURIER ANALYYSIS OF CT SIGNALS 5 Hrs.

Representation of signal using Fourier series., Fourier spectrum, Fourier transform, properties of Fourier transform, system analysis using Fourier transform.

4 FOURIER ANALYSIS OF DT SIGNALS 5 Hrs.

Fourier transform of DT signal, relation between Z- transform and DTFT, existence of Fourier transform, properties of DTFT. Frequency response of DTLTI system

5 SAMPLING AND RECONSTRUCTION 4 Hrs.

Sampling theorem in Time domain and Frequency domain, Signal reconstruction, Effect of under sampling : aliasing

6 SYSTEM MODELLING AND REALIZATION 6 Hrs.

Modelling of mechanical and electrical systems, CT & DT systems, realization of system Direct form I & II , cascade form, parallel form, Lattice – ladder structure .

REFERENCE BOOKS

Signals & Systems –
By- P. Ramesh Babu, R. Anand natranjan
Publication : Scientech,

Signals & Systems – Continuous and Discrete
By- Rodger E. Ziemer. W.H. Tranter, D. Ronald Fannin,
Publication : Maxwell Mac-Millan. Int.

Introduction to Signals & Systems –
By- Edward W. Kamen,
Publication : Maxwell Mac-Millan. Int.

Signals & Systems –
By- A.V. Oppenheim, A.S. Wilsky,
Publication : P.H.I.

Signals & Systems –
By- K. Uma Rao, Andhe Pallavi

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Sem. – VI (5)

INDUSTRIAL MANAGEMENT .

Teaching scheme :
Lecture Scheme : 3 hrs / per week

Examination scheme:
Theory : 100 marks(3 Hrs.)

SECTION : I

1) Business Environment : 2 Hrs.

Introduction , Environmental factors, influencing business, external environment, General environment, Task environment, Business ethics and social responsibility of business. Effects of Globalization.

2) Functions of Management: 9 Hrs.

Definition of management, Management environment,

Planning : Need, Objectives, Strategy , Policies, Procedures, Steps in Planning, Decision making, Forecasting.

Organizing : Process of organizing importance and principle of organizing, Departmentation, Organizational relationship, Authority, Responsibility, Delegation, span of control ,

Staffing : Nature , Purpose , Scope , Human resource management, Policies, Recruitment Procedure Training & Development, Appraisal methods.

Leading : Communication processes – Barrier , Remedies, Motivation, Importance, Theories, Herzbeg's Theory, Maslow's Theory, McGrager Theory, Leadership style,
Controlling : Process, Requirements for control Management, Accountability.

3) Engineering Economics : 5 Hrs.

Introduction to Basic Economics Terms such as Demand & Supply, Introduction, Time value of money, Cash flows, Depreciation, Types of depreciation, Reasons for depreciation, Methods of computing depreciation, Sinking Fund method, Declining Balance method, Investment decisions for capital assets, Evaluation criteria for Investment decisions, Payback period, Average rate of return. Benefit cost ratio (BCR), Cost accounting.

4) Financial Management : 4 Hrs.

Sources of finance, Financial statements, Balance sheet and P & L accountant, Break even analysis and its application, Accounting ratios, Cost and cost control, classification of cost – direct cost, indirect cost, overhead, cost estimation of process, cost control and cost reduction.

SECTION : II

5) Marketing : 3 Hrs.

Marketing Concepts :- Objectives- Types of markets, Market Segmentation, Market strategy -- 4 AP's of Market, Market Research, Salesmanship, Advertising.

6) Production Management : 6Hrs.

Selection of site, plant layout - objectives , principles, types, merits and demerits of different types of plant layout, Function of Production Planning and Control (PPC), PERT / CPM, Maintenance Management, Introduction to Industrial Engineering, Work Study, Method Study, Work Management , Wages & Incentives.

7) Materials Management : 5Hrs.

Definition, Scope , Advantages of Material Management, Functions, Material management, Materials requirements Planning, Purchasing objectives, 5-R Principles of purchasing, Functions of Purchase Department, Purchasing cycle, Purchase policy and procedure, Evaluation of purchase performance, Vendor selection, Vendor rating , Make or Buy decisions, Inventory control – ABC Analysis, EOQ, Inventory cost relationship

8) Industrial Acts and Industrial Safety : 2 Hrs.

Important provisions and Rules of Indian Factory Act : Reasons for Accidents, Prevention of Accidents, Promotion of safety mind ness

9) Entrepreneurship and Small scale Industry : 4 Hrs.

Concept of an Entrepreneurship, Qualities required to become Entrepreneurs, Definition of small scale Industry, Procedure to start small scale industry, Assistance and Incentives to SSI, Feasibility report writing. Concept of MIS

Suggested Books

1) Management - James A.F .stoner , R.E Edward Freeman , PHI Publication , New Delhi .
2) Management Today – principles and practice – Gane Burston and manab Thakur, Tata McGraw hill publishing company New Delhi.

3) Human Behavior at work organization Behavior – Keith Davis – TATA McGraw Hill Publishing Company New Delhi
4) Business Management – J. p .Prose ,S.Talukdar –New Center Agencies Ltd
5) Industrial Organization and Management – M.T.Telsang, S.Chand & Co.
6) Industrial Organization and Engineering Economics – T.R. Banga./ S.C. Sharma, Khanna Publisher,
7) Industrial Engineering and Management – O. P.Khanna .Dhanpat Rai Pub

8) Industrial Engineering and production management – by M.T.Telsang.- S. Chand

9) Marketing Management – Philip Kotler, PHI

10) Managerial Economics – Mote & Paul, TMH

11) Financial Management 6 th edition – Prasanna Chandra-TMH

12) Costing and Cost Control- Jawahar Lal, TMH

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Sem. – VI (6)

SOFT SKILLS

Teaching Scheme	Examination Scheme
Lectures: 1 hrs/ Week	Term Work : 50 marks
Practical: 2 hrs / Week	

1. Introduction: People in social context, skills, skill sets, hard & soft skills, scope for developing soft skills. 2 Hrs
2. Self Improvement:
   Self Analysis- Attitude, Aptitude, Assertiveness, Self esteem, Confidence, motivation, SWOT analysis.
3. Self Development- Goal setting, Action plans, Time management, change management, stress management, creativity, innovation & Entrepreneurial skills. 2 Hrs
4. Interpersonal skills: Communication Skills- Voice, language, Body language, Attire, use of communication aids, presentation skills with focus on seminars. Negotiation and conflict resolution skills 2 Hrs
5. Interview Techniques: Personal Interview – understanding the interviewer, interviewee and interview dynamics. Improving through FAQ's & understanding the common mistakes.
   Group Discussions: Types of GD's, mode of conduct, personal & interpersonal traits evaluated. Do's & Don't's in Group Discussions.
6. Resume Writing: types, contents, fields & creating impact. Net etiquettes 2 Hrs
7. Working in Teams: Understanding group dynamics & working effectively within teams. Defining common objectives, building rapport, motivation, leadership, problem handling. Planning for project work & use of project evaluation tools. Gender etiquettes.
8. Task Management: Identification, planning, organizing, execution & closing the task. 2 Hrs
9. Problem Solving: Steps- Identification & clarification, Information gathering, exploring alternate solutions, Evaluation & selection, implementation, review & iteration as necessary.
   Techniques- Trial & error, Brain storming, lateral thinking. 2 Hrs

Term Work:

Term work will consist of at least eight activities from the following list:

1. SWOT analysis by each student & goal setting.
2. Identifying sources of stress & undertake one method to cope with it.
3. Short presentations to demonstrate communication skills.
4. Small group activity on poster/model presentation.
5. Group Discussion on current issues.
6. Case study of a Successful personality or Mock Interview.
7. Invited expert lecture by a doctor / industrialist on personality development / job related issues.
8. Resume writing
9. Preliminary draft of proposed seminar.
10. Preliminary draft of proposed project work.

Reference Books:

1. Developing soft skills, Sherfield Montgomery & moody
2. Presentation skills, Michael Hutton, ISTE
3. Target setting & goal achievement, Hale & Whilom, Kogan Page
4. Entrepreneurship for Everyone, Robert Keller, Kingston Univ.
5. Emotional Intelligence, Daniel Golman
6. Working in Teams, Harding, orient Longman
7. Adam's Time Management, Marshall cooks, viva books

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Sem. – VI (7)

VISUAL BASIC & LAB VIEW

Teaching Scheme
Lectures: 3 hrs/ Week
Practical: 2 hrs / Week

Examination Scheme
Term Work : 50 marks

SECTION : I

VISUAL BASIC

1 VISUAL BASIC CONCEPTS : 3 Hrs
Concepts, Cross object, property, events, project, forms, Menus, etc. Controls & events : Scroll bar, slider, frame, picture box, Image, File system controls, Timer & OLE control, Basic controls.

2 VISUAL BASIC PROGRAMMING : 3 Hrs.
Data types, Arrays, procedures, functions, control flow & loops, operators, Date & time formats, buttons & boxes, statements.

3 MODULES & CONTROLS : 6 Hrs
Modules, Class module MDI, Menu Editor, Advanced controls : Tree view, dialog box, image list etc, Report generator : Concept of data base, record, record set, connection. DSN etc.
Data bound controls : text, combo, listbox. DB grid, DB combo, MS Flex grid. Visual data manager, object connection, record set, parameter,
cursor & lock types. Creating reports using data & crystal report. Active X controls.

4 FILE HANDLING IN VB : 4 Hrs
File commands & file handling functions, sequential files : Reading information from file, Adding to existing files, Random access files,

SECTION : I I

LAB VIEW

PURPOSE :
To study Lab View software as a toll to develop HMI, to implement SCADA and for interfacing process parameters to PC for developing PC based Instrumentation.

Sr.	TOPIC	Lect. Hrs.
1	REVIEW OF VIRUAL INSTRUMENTAITON : Historical perspective, advantages, block diagram and architecture of a virtual Instrument.	2
2	DATA FLOW TECHNIQUES : Graphical programming in data flow, comparison with conventional programming.	1
3	ADDON PERIPHERAL CARDS, SELECTION AND APPLICATION : ADC, DAC, DIO, DMM, wave form generator.	2
4	INTRODUCTION TO LABVIEW SOFRWARE AND ADDON TOOLSETS**.**	2
5	LABVIEW: VI and sub-Vis, loops and charts, arrays, clusters, and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O	3
6	APPLICATIONS OF VIRTUAL INSTRUMENTATION : Process control applications, Temperature Data Acquisition System, and Motion control employing stepper motor.	2

References:

1) National Instruments User manual
2) National Instruments product catalog
3) Virtual Instrumentation Using Lab view by Gupta S. (TMH)

REFERENCE BOOK :

1) Programming in VB By: P.K. McBride
2) Mastering in VB By: Evangelos Petroutsos
3) The complete reference VB.6 By: Noel Jerke
4) Programming in VB.6 By: Rajendra Salokhe

EXPERIMENTS :

Minimum 15 experiments should be performed related to syllabus contents. And 1 mini project related to Process Instrumentation for Termwork
(Minimum 4-5 students / group for Mini project)

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Shivaji University, Kolhapur

Equivalences of T.E. Instrumentation for repeater students

T.E. (Instrumentation) Sem.-V

Sr. No.	Pre-revised subjects	Sr. No.	Revised subjects
1	Fiber Optics & Laser Instrumentation	1	Fiber Optics & Communication
2	Modern Control Theory	2	Advanced Control Systems
3	Microprocessor Techniques & Interfacing	3	Industrial Automation-I
4	Industrial & Power Electronics	4	Industrial Power Electronics
5	Industrial Organization & Resource Management	5	Industrial Management
6	Programming Techniques –II	6	MATLAB Programming

T.E. (Instrumentation) Sem.-VI

Sr. No.	Pre-revised subjects	Sr. No.	Revised subjects
1	Process Instrumentation	1	Process Control
2	Chemical & Analytical Instrumentation	2	Analytical Instrumentation
3	Microcontrollers & Applications	3	Microcontrollers & Applications
4	Biomedical Instrumentation	4	Signals and Systems
5	Unit Operation	5	Unit Operation
6	Metrology & Precision Measurement	6	Visual Basic and Lab view
7	Practical Training / minor Project / Industrial Visits	7	Soft Skills