SHIVAJI UNIVERSITY, KOLHAPUR

Structure for Instrumentation Engineering Degree Course

Introduced from July 2008

S.E. (Instrumentation) Part –I

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				Examination Scheme (Marks)				
--	--	L	T	P	Total	Theory	TW	POE	Oral	Total
1.	Applied Engineering mathematics	3	1	--	4	100	--	--	--	100
2.	Electrical Machines	4	--	2	6	100	25	50	--	175
3.	Electrical Measurements & Instruments	4	--	2	6	100	50	--	25	175
4.	Circuit Theory & Analysis	3	1	--	4	100	--	--	--	100
5.	Electronic Devices & Circuits	4	--	---	4	100	---	---	---	100
6	Instrumentation system components	2	--	2	4		50	---	---	50
7	Laboratory practice-I	--	--	2	2	--	50	50	---	100
	Total	20	2	8	30	500	175	100	25	800

Note: 1) Laboratory practice – I will consists of at least 8 experiments each from subject nos. 4 & 5.
2) Term work marks will be based on unit test, assignment, internal oral, Journals & attendance

S.E. (Instrumentation) Part –II

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				Examination Scheme (Marks)				
--	--	L	T	P	Total	Theory	TW	POE	Oral	Total
1.	Digital systems& microprocessor	3	--	--	3	100	--	--	--	100
2.	Automatic control systems	4	--	2	6	100	25	50	--	175
3.	Sensors & Transducers	4	--	2	6	100	25	50	---	175
4.	Thermal & fluid power Engineering	3	--	2	5	100	25	--	--	125
5.	Linear Integrated circuits	4	--	---	4	100	---	---	---	100
6	Programming Technique –I	2	--	2	4	--	50	---	--	50
7	Laboratory practice-II	--	--	2	2	--	25	50	---	75
	Total	20	--	10	30	500	150	150	--	800

Note: -- Laboratory practice – II will consists of at least 8 experiments each from subject nos. 1 & 5.

SHIVAJI UNIVERSITY, KOLHAPUR

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T.E. (Instrumentation) Part –I

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				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	4	--	2	6	100	50	50	---	200
4.	Industrial Management	3	--	-	3	100	--	--	--	100
5.	Analytical Instrumentation	3	--	2	5	100	25	---	25	150
6	Programming Technique –II	2	--	2	4	--	50	--		50
	Total	20	--	10	30	500	200	50	50	800

T.E. (Instrumentation) Part –II

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				Examination Scheme (Marks)				
--	--	L	T	P	Total	Theory	TW	POE	Oral	Total
1.	Microcontrollers & Applications	4	--	2	6	100	25	50		175
2.	Industrial Automation – I	4	--	2	6	100	25	-	25	150
3.	Process Instrumentation	4	--	2	6	100	50		25	175
4.	Signals & systems	3	--	-	3	100	--	--	--	100
5.	Unit operation	3	--		3	100	---	---	--	100
6	Soft skills	1	--	2	3	--	50	--	----	50
7	Programming Techniques -III	1	--	2	3	---	50	--	---	50
	Total	20	--	10	30	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.-I) for assessment .

SHIVAJI UNIVERSITY, KOLHAPUR

Structure for Instrumentation Engineering Degree Course
Introduced from July 2010

B.E. (Instrumentation) Part –I

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				Examination Scheme (Marks)				
--	--	L	T	P	Total	Theory	TW	POE	Oral	Total
1.	Advanced process Instrumentation	4	--	2	6	100	25	--	25	150
2.	Instrumentation system design	4	--	2	6	100	25	-	25	150
3.	Industrial Automation -II	3	--	2	5	100	25	--	25	150
4.	Digital signal Processing	4	--	2	6	100	25	--	--	125
5.	Elective I	3	--	2	5	100	50	---	--	150
6.	Project work phase-I & Seminar	--	--	2	2	--	25	--	--	25
7.	Industrial Training	--	--	--	--	--	25	--	--	25
8.	Comprehensive Tests	--	--	2	2	--	25	--	--	25
	Total	18	--	14	32	500	225	--	75	800

Note: 1) Subject no.7 will consist of assessing the Industrial Training (and training report) under taken by the students at the end of 6th semester.
2) Subject no.8 will consist of review tests on all subjects from SE to BE-I.

B.E. (Instrumentation) Part –II

Sr No.	Name of the Subject	Teaching Scheme (Hrs.)				Examination Scheme (Marks)				
--	--	L	T	P	Total	Theory	TW	POE	Oral	Total
1.	Field Instrumentation & Networks	4	--	2	6	100	50	--	--	150
2.	Process Modeling & Simulation	4	--	2	6	100	25	-	25	150
3.	Project Planning Estimation & Assessment	4	--	2	6	100	50	--	25	175
4.	Elective II	4	--	2	6	100	25	---	25	150
5.	Project Work phase - II	--	--	6	6	--	75	--	100	175
	Total	16	--	14	30	400	225	--	175	800

Elective I
1) Embedded Systems
2) Power Plant Instrumentation
3) Optimal & Robust Control
4) Mechatronics

Elective II
1) Biomedical Instrumentation
2) Virtual Instrumentation
3) Neural & Fuzzy Based Control
4) Advanced Digital Signal Processing

S.E. INSTRUMENTATION –PART I
APPLIED ENGINEERING MATHEMATICS

Teaching Scheme: -
Lectures: 3 Hrs/week
Tutorial: - 1 Hr/Week

Examination Scheme:-
Theory: 100 Marks

SECTION -I

1) Introduction to Fuzzy sets: - Crisp sets, Crisp sets verses fuzzy sets. 3hrs

2) Linear differential equations: - Linear differential equations with constant coefficients, Homogeneous linear differential equations, Applications to electrical engineering problems. 6hrs

3) Partial differential equations: - Four standard forms of partial differential equations of first order. 5hrs

4)Fourier series : - Expansions of functions in Fourier series , Change of interval, Even & Odd functions, Half range Fourier series. 6hrs

SECTION-II

1) Laplace Transform :- Definition , Properties of Laplace transform, convolution theorem, Laplace transform of periodic function, unit step function and impulse function. 5hrs

2) Inverse Laplace Transform: - Inverse Laplace transform, Inverse Laplace transform by partial fraction method, by-convolution theorem, Application to solve linear differential equations with constant coefficients. 5hrs

3) Vector Calculus: Normal and tangential components of velocity and acceleration, Gradient, Divergence and Curl of a vector point function, Solenoid, irrotational and conservative vector fields. 5hrs

4) Z- Transform: - Z -transform of elementary functions, properties of Z and inverse Z-transform. 5hrs

Nature of question paper: -

1) There should be two sections carrying 50 marks each.
2) There should be four questions topic-wise in each section and any three questions should be attempted from each section.

Recommended Books: -

1) Fuzzy sets and Fuzzy logic by George J Klir, Bo Yuan

2) A Text Book of Applied Mathematics Vol I and Vol II by J.N.and P.N Wartikar ~ Vidyarthi Grisha Prakashan, Pune.
3) Higher Engineering Mathematics by B.S.Grewal- Khanna Publication, Delhi.
4) H. K. Dass - Advanced Engineering Mathematics.
5) Advanced Engineering Mathematics by Jaggi and Mathur - Dhanpatrai and Sons, Bhopal.

6) A Text book on Engineering Mathematics by N.P.Bali, Ashok Saxena and N.Ch.S.N.Iyengar- Laxmi Publication, Delhi.
7) Schaum series books : Advanced Calculus, Laplace transform, Vector analysis, Differential equations,

S.E. INSTRUMENTATION –PART I

ELECTRICAL MACHINES

Lectures : 4 hrs / week **Theory paper -100 Marks**
Practical : 2 hrs/ week **Practical and Oral – 50Marks**
Term Work -25 Marks

SECTION - I

1) D.C. Motors :- **8 hrs**

Speed control of D.C. series & shunt motors (numerical treatment) , Starters for D.C. motors, - 3 point, 4 point, face plate type controller, Electronic starter, Electric braking of D.C shunt & series motors, Testing methods - Brake load test, swinburne's test.

2) Polyphase Circuits **6hrs**

Introduction to 3 phase system, Star & Delta connections, Relationship between line and phase quantities, measurement of Active & Reactive power in 3 phase balanced loads by two watt meter and one watt meter method, Calculation of load power factor by two wattmeter method (numerical treatment) Effect of load power factor on two wattmeter readings.

3) Three phase transformers: - **5 hrs**

Construction, types, connections of 3 phase transformer : star / Delta, Delta / Star , Star/ Star , Delta / Delta, Vee-Vee connection, Scott connections.- 3 phase to 3 phase, 3 phase to 2 phase conversion.

4) Synchronous Machines: - **8 hrs**

Three phase alternators,- construction types e.m.f. equation, parallel operation and synchronizing.

Three phase synchronous motors :-

Construction, working principle, effect of change in excitation on armature current and power factor, Vee curves, methods of starting, hunting , applications.

SECTION-II

5) Three phase induction Motors :- **10 hrs**

Construction, types, Production of rotating magnetic field, working principle and operation of motor. Equations of starting torque, maximum torque, torque under running conditions, Ratios Ts / Tmax, Tf / Tmax, Torque – sleep characteristic, effect of rotor resistance on Tmax, Power stages in motor (numerical treatment) equivalent circuit. Speed control from stator and rotor side, starters for 3 phase induction motor .

6) Special Purpose Machines: - **6 hrs**

Stepper motors- types, applications, construction and working of variable reluctance and permanent magnet stepper motors

Servo motors – Construction, working of D.C. & A.C. motors, applications

Reluctance and Hystersis motor - Construction, working , applications.

Tacho generators & Synchros,

7) Power factor correction: - **4 hrs**

Causes of low power factor, disadvantages of Low P.F. Methods for P.F.

improvement (numerical treatment)

References Books :-

1) Control system Engineering – I.J. Nagrath , M. Gopal
2) Electrical Machinery (Sixth edition)- A.E. Fitzgerlad

Text Books :-

1) Electrical Technology (vol I & II) B.L.Theraja

2) Principles of Electrical Machines – V.K. Mehata

List of Experiments (Minimum 8 Expt. Should be performed) :-

1) Speed control of d. c. shunt motor by Armature voltage control method,
2) Speed control of d. c. shunt motor by flux control method,
3) Brake load test on d.c. shunt motor
4) Swinburne's test on d.c. shunt motor.
5) Measurement of active & reactive power in a 3 phase balanced load by **one** wattmeter method.
6) Measurement of active & reactive power in a 3 phase balanced load by **two** wattmeter method.
7) Load test on 3 phase induction motor
8) Study of 3 phase induction motors starters
9) To plot V curves and power factor curves for 3 phase synchronous motor.
10) Performance of various types of 3 phase transformer connection
11) Load test on d.c. series motor.

S.E. INSTRUMENTATION –PART I

ELECTRICAL MEASUREMENTS AND INSTRUMENTS

Teaching Scheme :- **Examination Scheme**

Lectures : 4 hrs / week **Theory: 100 Marks.**

Practical : 2 hrs / week **Term Work : 50 Marks**

Oral: 25 Marks

Section-I

Introduction: 5 hrs

Block diagram of Generalized Instrumentation system, classification of instruments, Methods of measurement, Fundamental and derived units, classification of measurement standards, Measurement standards for Resistance inductance, capacitance, current, voltage, frequency, luminous intensity, Temperature etc. Introduction to Reliability and safety standards, ISI standards

Performance Characteristics: 5 hrs

Static Characteristics : Accuracy, precision , errors, linearity , resolution, sensitivity, threshold, dead zone, repeatability, drift ,Hysteresis, noise, impedance loading and matching, calibration etc.
Dynamic Characteristics: Speed of response, fidelity, lag, dynamic error etc.
Dynamic response of indicating instruments for step, ramp, impulse and sinusoidal input for first and second order system., Instrument specification, factors affecting instrument selection .
Calibration: types - primary , secondary, direct, indirect & routine calibration.

Measuring Instruments : 8 hrs

D' Arsonval Galvanometer, Ballistic Galvanometer Principle, working application, advantage & disadvantage of i) PMMC ii) M-I iii) Dynamometer type instrument, Study of Ohm meter, multimeter, energy meter, flux meter.
Digital meters : 1) Integrating and non integrating type voltmeter
2) Frequency, time, and phase measurement

Electrical Interference and Grounding: 3 hrs

Electrical interference : Type of interference , Electric field shielding, magnetic shielding, grounding and isolation., Noise types, Electrical grounding : A C power ground , instrument ground ,Ground connection in measurement system , RF and shield grounds, Specific interference, source reduction techniques

Section II

Comparison type Measuring Instruments : 5 hrs

D.C. bridge: whetstone bridge, kelvins bridge, kelvins double bridge (principle, working, advantage & disadvantage)
A C bridges:
Measurement of inductance : Maxwells bridge, Andersons bridge,Hay Bridge
Measurement of mutual inductance : Hearyside bridge, campbelPs bridge,
Measurement of capacitance : Desauty's bridge, schering bridge,
Measurement of frequency : Wein bridge,
Errors in bridge circuits and Remedy, wagner earthing device,
D.C / A.C potentiometers.

Oscilloscope: 7 hrs

Block diagram of CRO, CRT, Screen for CRO, control panel of CRO, Horizontal deflection system, vertical deflection system,
Types of Oscilloscope: Dual beam, dual trace, sampling digital storage Oscilloscope,
CRO accessories: Passive and active probes,
Application of CRO: Measurement of phase, frequency using lissijous patterns .Measurement of inductance and capacitance

Signal Generator, Analyzers and miscellaneous: - 6 hrs

Signal generator: AF sine wave & square wave generator, square wave & pulse generator (lab type) , Random noise generator, function generator, pulse generator
Signal Analyzer: Harmonic distortion analyzer, spectrum analyzer , logic analyzer, Fourier Analyzer , FFT analyzer, wave analyzer,
LCR-Q meter, RF power meter, PH meter (Principle, Block diagram, working and application.)

Recorders: 5 hrs

Necessity of recorders, recording Requirements, Analog Recorders, Strip Chart Recorders ,and its types, Multipoint Recorder, X Y recorder, Ultraviolet Recorders, Digital X-Y recorder, Digital memory waveform recording. Computer controlled measurement system.

Reference Books:

1 Cooper llelfric - Modern Electronic Instrumentation and Measurement Technique - PHI
2 Kalsi U.S. - Electronic Instrumentation — TATA McGrawHill Publication.
3 Clyde f Coombs, Jr - Electronic instrumentation Handbook.
4 A.K.Sawhney - A course in Electrical & Electronic measurement & Instrumentation.
5 Oliver Cage- Electronic Measurement and Instrumentation -TMG.

Suggested Experiments:

1) Design and Calibration of ohmmeter (series & shunt type)
2) Calibration of wattmeter for resistive load
3) Energy meter calibration
4) Measurement of frequency and phase on CRO
5) Measurement of L and C using CRO
6) Measurement of R using whetstones bridge and kelvin's double bridge
7) Calibration of Ammeter, voltmeter, wattmeter using d.c. potentiometer

8) Measurement of reactive elements using A C bridges
9) Design and study of signal generation using 803 8
10) Study of dual trace CRO
11) Curve tracer to plot transistor o/p characteristics using CRO
12) Study of y-t and x-y recorders.
13) Study of parameters of capacitor (quality factor, reactance, effect of temperature)
14) Study of parameters of inductor.(Reactance ,impedance ,Dissipation factor, Quality factor, effect of temperature)
15) Study response of first order and second order for step input of the system.
16) Measurement of inductance using Maxwell Bridge.
17) Measurement of capacitance using Schering Bridge.
18) Study of LCR-Q meter.
19) Simulation of function generator, Oscilloscope using Lab-View.
20) Simulation of analog and digital voltmeter, ammeter.

Note: Students are expected to perform any ten experiments

S.E. INSTRUMENTATION –PART I
Circuit Theory and Analysis

Lecture: 3 hrs / week. **Theory: 100**
Tutorial: 1 hr/week

Section – I

1) Basic circuit concept: 4 – hrs.
Active and passive circuit elements, Independent sources, dependent sources, current divider, source transformation, energy storage elements.

2) circuit Analysis and Network Theorems 10 – hrs.
series and parallel circuits, Node analysis, Mesh analysis, KVL,KCL, Linearity, Proportionality and superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, delta-wye transformation, compensation theorem, Millman's theorem, Principle of duality, compensation theorem, network solution by laplace transformation techniques .

3) Two port Networks : 6 – hrs.
Introduction, open-circuit impedance (Z) parameters, short circuit admittance (Y) parameters, hybrid parameters, transmission parameters, Inter relationships of different parameters, Inter connection of two port networks, lattice network.

Section – II

4) Resonance : 5-hrs.
series and parallel resonance, Impedance at resonance, current at resonance,variation of capacitor voltage and inductor voltage with frequency, Q –factor ,bandwidth and selectivity.

5) Filters and attenuators : 6-hrs.
Introduction, parameters of filters, decibel and neper, propagation constant, classification of filters, Low pass, high pass, band pass and band stop filters, characteristics of filters, constant– K filters, m – derived filters, composite filter.
Attenuators : types of attenuators, T – type, pi- type, lattice, bridged – T, L – type attenuators.

6) Transient Response – 4-hrs.
steady state and transient response, DC response of an R-L, R-C and R-L-C circuit, sinusoidal response of an R-L, R-C and R-L-C circuit.

7) Fourier Analysis and frequency spectrum – 5-hrs.
Introduction, Periodic waveforms, Fourier series, evaluation of Fourier coefficients, Even and odd symmetry, convergence of Fourier series, network analysis using Fourier series

Reference Books :-

1) Circuits and networks: Analysis and synthesis
A. sudhakar, shyammohan sp (Tata Mc-Grawhill)
2) Network analysis and synthesis – Umesh sinha.
3) Electric circuit Analysis – P. Ramesh babu
4) Network analysis and synthesis – M. Arshad (Laxmi public.)
5) Network analysis and synthesis – Soni Gupta
6) Introduction to Electric circuit - R.C.Dorf, J.A. Svoboda (Wiley Publications)
7) Network Analysis By M.E. Van Valkenburg (Third Edition)

Suggested Experiment (Practical or Simulation) :-

1) Kirchoffs Law justification.
2) Maximum power transfer (practical justification)
3) Thevenin's theorem and Norton's theorem for
a)A.C Circuit b) D.C Circuit.
4) Plotting of behavior of RC circuit for step input.
5) Plotting of behavior of RI circuit for step input.
6) Plotting of behavior of RLC circuit for step input.
7) Plotting of behavior of RLC circuit for ramp input.
8) Frequency response of series resonance circuit.
9) Fourier series analysis of square wave.
10) Fourier series analysis of triangular ware.
11) Determination of Z,Y & H parameter of given network.
12) To determine frequency response of Low pass, high pass, band passes RLC Filter.

S.E. INSTRUMENTATION –PART I
ELECTRONIC DEVICES AND CIRCUITS

Lectures :- 4 period / week **Paper - 100 Marks**

SECTION - I

1. **Application of semiconductor diodes :-** **08 Hr**

Rectifiers : Half wave, Centre tapped, full wave, bridge rectifiers. Analysis of above circuits for ripple factor. Rectification efficiency TUF, PIV etc.

Filters : Inductor, capacitor and pie filter and its analysis for ripple factor

Application of diode in clipper and clampers circuits.

Zener Diode : Construction and working, VI characteristic and application as voltage regulator.

2 Transistor Biasing : - **07 Hrs.**

Need of biasing, Q pt., D.c. and A.c. load line, Stability factor, Different biasing circuit, Fixed bias, collector to base bias, Voltage divider or self biasing. Analysis for stability factor of above circuits.

Hybrid model for C.E. configuration , Determination of H parameter, from Transistor characteristics

3 **Amplifiers :-** **5 Hrs.**

Classification based on coupling network, output power and frequency of operation. Detailed analysis of single stage R.C. Coupled amplifier, frequency response (Therotical explanation) Need of cascading, analysis of two stage R.C.Coupled amplifier.

SECTION – I I

4 **Feed back Amplifier:-** **8**

Need of feedback , types of feedback, comparision between positive and negative feedback. Types of negative feedback (Voltage series, voltage shunt, Current series and current shunt) Detail analysis of voltage series feedback.

Applications of positive feedback in oscillator Barkhauson criteria , classification of oscillators,

R.C. Oscillators:- Phase shift & Wein bridge

L.C. Oscillators :- Hartley and colpitts

Analysis of above circuits for frequency of oscillators.

5 **Multivibrators :-** **8 Hrs.**

Introduction, Classification astable, monostable, bistable, schimtt trigger, circuit operation, wave forms, and analysis of above circuits. Different triggering circuits,

6 **Power amplifiers : -** **4 Hrs.**

Comparision with voltage amplifiers, classification class A, class B, class AB,

class C, push pull amplifiers- class A, class B, class AB. Distortion in power amplifiers- Harmonics and crossover.

Referance Books:-

1. Electronic devices & circuit , an Introduction PHI publication. Allen Mottershed
2. Basic electronics and Linear circuits By Bhargav Gupta
3. - Electronic Devices & Circuits : R.S. Sedha & Theraja B.L.
4. Fundamental of Electrical Engineering and Electronics : Theraja B.L.
5. Pluse digitals & switching waveforms : Jacob Milla Hebbert ,Taxali
6. Electronic devices & circuit : David Bell

S.E. INSTRUMENTATION –PART I

INSTRUMENTATION SYSTEM COMPONENTS

Teaching Scheme: **Examination scheme**

Lectures : 2 Hrs/week

Practical : 2 Hrs/week **Term Work :50Marks**

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1. Industrial control devices **3hrs.**

Switches: Construction, types, symbolic representation, working and applications- toggle switch, slide switch, DIP switch, Rotary switch, thumbwheel switch, selector switch, push button, limit switch, temperature switch, pressure switch, level switch, flow switch. Photoelectric switch, Indicators & displays.

Relays: Types, working, specification/selection criteria and applications of electro-mechanical relay, reed relay, solid state relay.

Contactors: Types, working, specification and applications, concepts of sequencing & interlocking.

2. Pneumatics: **4hrs.**

Pneumatic components. -Standards and symbols, Source of pneumatic power-Compressor, Filter regulation lubrication (FRL) Unit, Air receiver, Actuators-Rotary, Linear, Control Valves for pressure, flow and direction, Time delay valve, typical pneumatic circuits.

3. Hydraulics: **4hrs.**

Hydraulic components,: Standards and symbols, Hydraulic power pack, Hydraulic pumps, Actuator(Cylinder & motors),Control Valves, Hydraulic servo mechanism, Typical Hydraulic circuits

4 Transmitters: **3hrs.**

Need of transmitter (concepts of field area and control room area), need for standardization of signal, current, voltage and pneumatic signal standards, concepts of line and dead zone.
Converter: Working & Specifications of I/P and P/I converter, Span and zero adjustment. .

5. Control Valve: **4hrs.**

Necessity and comparison, final control elements, classification of control valve based on valve body, construction, type of actuation and application.Construction Advantages, disadvantages and application of globe: single, double, 3 way angle, gate, needle, diaphragm, rotary valve.

6. Auxiliary Components: **4hrs.**

Construction, working and applications of damper, alarm annunciater, square root extractor, high/low selector, flow totalizer, seals,
Electronic components and specifications: Fixed & Variable Resistors, capacitors, inductors, Transformer, Connectors, power supplies, batteries & relays.
Safety measures, Hazardous area classification and standards.

List of Experiments: At least 2 experiments each in Sr.no 1 & 2, and 4 experiments each in Sr.no 3 & 4.
1) Study of Electrical & Electromechanical components – resistors, inductors, capacitors, switches, relays, and contactors, I /P & P /I converters, etc.
2) Study of Pneumatic & Hydraulic components – Sources, filters, control valves, actuators, fittings, etc.
3) Implementation of Pneumatic circuits.
4) Implementation of Hydraulic circuits.
5) Visit/Study of one commercial/industrial Pneumatic/Hydraulic system in detail.

Reference Books:

1. Industrial Electronics – Petruzella

2. Industrial Hydraulics - Pipenzer
3. Pneumatic controls - Joji P , WIPL
4. Eton(VICKER'S) Manual.
5. Process Control – Instrumentation Engineer Handbook – B.G. Liptak
6. Process Control & Instrumentation Technology – C. D. Johnson
7. Instrument Technology – E.B. Jones
8. Control system component center : Technical co-ordination
9. Manuals Pneumatics – Festo Didactic
10. Manuals Hydraulic – Festo Didactic

S.E. INSTRUMENTATION –PART I
LABORATORY PRACTICE: I

Teaching Scheme: **Examination scheme**

Practical 2 Hrs. / Week **Term work 50 Marks**

P.O.E . 50 Marks

Laboratory practice – I will consist of at least 8 experiments each from subject nos. 4 & 5.

Suggested Experiment (Practical or Simulation) from subject No. 4 :-

1) Kirchoffs Law justification.
2) Maximum power transfer (practical justification)
3) Thevenin's theorem and Norton's theorem for
a)A.C Circuit b) D.C Circuit.
4) Plotting of behavior of RC circuit for step input.
5) Plotting of behavior of RI circuit for step input.
6) Plotting of behavior of RLC circuit for step input.
7) Plotting of behavior of RLC circuit for ramp input.
8) Frequency response of series resonance circuit.
9) Fourier series analysis of square wave.
10) Fourier series analysis of triangular ware.
11) Determination of Z,Y & H parameter of given network.
12) To determine frequency response of Low pass, high pass, band passes RLC Filter.

Suggested Experiment from subject No. 5 :-

1. V-I Characteristics of Zener diode
2. Study of unregulated power supply
3. Study of rectifiers:- a)—Halfwave, b) Full wave c) Bridge
4. Study of clipper circuits
5. Study of clamper circuits
6. Zener diode as voltage regulator
7. I/O characteristic of C.E. characteristic
8. Study of single stage R.C. Coupled amplifier

9. Study of R.C. Oscillators.
10. Study of L.C. Oscillators.
11. Study astable multivibrators
12. Study of monostable multivibrators
13. Study of schimitt triggers
14. Study of class A power amplifier.
15. Study of Superposition theorem
16. Study of Thevenins theorem
17. Study of Nortons theorem
18. Study of Maximum power transfer theorem
19. Study of Superposition theorem
20. Study of Thevenins theorem
21. Study of Nortons theorem
22. Study of Maximum power transfer theorem
23. Study of superposition theorem
    a) Study of Nortons theorem
    b) Study of Thevenins theorem
    c) Study of Nortons theorem
    d) Study of Maximum power transfer theorem

24 Study of Two port network

Z -parameter

Y – parameter

H – parameter

ABCD –parameter

25 study of Resonance

a) Series Resonance
b) Shunt Resonance

S.E. INSTRUMENTATION –PART II

Digital Systems & Microprocesso*r*

Lecture : - 3/Week **Theory : - 100 Marks**

Section I

1. Binary Codes – Weighted, Gray, Error detecting codes, Odd, Even parity, **04Hrs.**
Hamming codes, Alphanumeric, ASCII, EBCDIC Codes, converting Binary to Gray and Gray to Binary. Representation of negative numbers using compliment methods.

2. **Logic gates & Boolean Algebra – 06 Hrs.**

Classification of logic families, TTL, CMOS, logic families & their Comparative study.

Realization of different gates using NAND & NOR gates. Simplification of logical expressions, using Boolean theorems & k-map (up to 4 variables).

Combinational Logic Circuits – Half subtraction , Full subtraction , Parallel Binary adders, BCD Adders, Parity Bit generating, Comparators, Multiplexer, Demultiplexer, encoder , Line Decoder (3 TO 8) 8421, BCD to 7 segment decoder, Display devices - LED, LCD.

Features, Pinout & applications of the following devices: 7400, 74244, 74245, 74373, 74LS138, 7447, 7448, FND 542, FND 543, 74181(ALU).

3. **Latches & Flip Flops – 04 Hrs.**

Latches- S-R & gated D types. Characteristic Equations & timing diagrams.

Flip Flops – S R, J – K, T, switch Debouncing Flip Flops with additional inputs. Characteristic Equations & timing diagrams.

4. **Shift registers & Counters - 04 Hrs.**

Shift registers -Types, Data transmission in shift register, Serial in parallel out, parallel in serial out & parallel in parallel out shift register.

Types of Counters - Synchronous, Asynchronous, Ring, up down, Mod N Counters, study of IC 7490 & IC 7493.

Section II

Microprocessor

1. **8085 Architecture** – Introduction to microprocessor, Features of 8085, 8085 CPU architecture, functional pin configuration, demultiplexing of address & data bus. 8085 Block diagram. 03 Hrs.

2. **8085 Introduction Set –** Addressing modes , Functional classification of instruction set and Programming. 04 Hrs.

3. **Memory –** Memory types Comparative study of RAM, ROM, PROM, EPROM, EEPROM, Memory organization and expansion. EPROM programming methods. Memory mapped & I/O mapped I/Os. 03Hrs.

4. **Analog Signal Interfacing :** 04 Hrs.

ADC : Quantization & Decision Level, Resolution, Quantization error, sample & hold, types single slope, dual slope, Successive Approximation & flash. IC808/809 Comparison of their performance parameters & suitability for applications.

DAC: R – 2R Ladder type & weighted resistors. Performance parameters. IC 808.

5. **8255 Programmable Peripheral Interface -** 02 Hrs.

Features, Block diagram, Functional pin Configuration, Control word, format & different modes & Interfacing to 8085.

6. Interfacing applications to 8085 – Keyboard, displays, ADC, DAC, Thumbwheel switches, Relays, Stepper motor. 02 Hrs.

Reference Books

1. Malvino leach, Digital Principles & electronics , TMH
2. A. Anand Kumar, Fundamental of Digital Circuit , PHI
3. Alan B Marcorits – Introduction to logic Design
4. Charles Roth – Fundamental & logic Design, Thomson
5. R.P. Jain – Modern Digital Electronics
6. Morris Mano – Digital Logic & Computer Design
7. Introduction to measurement & Instrumentation, Arun Ghosh, PHI
8. Microprocessor Architecture – Programming & application with 8085 – Ramesh Gaonkar
9. Microprocessor & Digital System – Donglous Hall
10. Microprocessor & Programmed Logic – Kenneth L. Shart

S.E. INSTRUMENTATION –PART II
AUTOMATIC CONTROL SYSTEMS

Teaching Scheme :-
Lectures : 4 hrs / week
Practical : 2 hrs/ week

Examination scheme :-
Theory paper -100 marks
Practical & Oral - 50 marks
Term Work - 25 marks

Extensive use of software package like MATLAB / SCILAB is to be made for enforcing control systems concepts & analysis.The MATLAB coverage is limited only for practical. No theory questions should be asked on MATLAB / SCILAB.

SECTION -1

1) Introduction:- **2 hrs**

Definition. Elements of control systems, examples of control systems, open loop and closed loop control systems, Linear vs Non-Linear control system, SISO and MIMO system, continuous and sampled data control.

2) Mathematical Modeling and system Representation: **I2 hrs**

Differential equations of physical systems such as Mechanical, Electrical, electromechanical , thermal , hydraulic, pneumatic , liquid level etc. Analogous systems, Force voltage analogy, force current analogy and torque current analogy , Transfer function, block diagram representation of control system, rules and reduction techniques .Signal flow graph-elements, definitions, properties, mason's gain formula, application of gain formula to block diagram .

3) Time domain analysis :- **10 hrs**

Standard test signals, transient response, steady state error and error constants. Time response of first order systems to unit and ramp input., second order systems to unit step input, transient response specifications. Effect of adding poles & zeros to transfer function, dominant poles of transfer function. Time domain analysis using MATLAB. Introduction to MATLAB, Control system toolbox.

SECTION -II

4) Root - Locus Technique :- **6 hrs**

Introduction, Basic properties of the root loci , general rules for construction of root loci . Sensitivity of the roots of the characteristics equation. , Root — locus analysis of control system using MATLAB.

5) Frequency domain analysis :- **10 hrs**

Concept of frequency response, performance specifications, co-relation between time domain and frequency domain responses. Frequency response plots- polar plots, Bode plots, , gain margin , phase margin. Effect of gain variation, adding poles /zero on Bode plot .Frequency response analysis using MATLAB.

6) Stability Analysis:- **6 hrs**

Concept of stability, definition, condition for stability , relative stability, Routh - HURWITZ criterion , . Nyquist stability criterion, Stability analysis using MATLAB.

Reference Books :-

1) Nise, Control systems Engineering - wse wiley publication
2) Ogatta, Modern Control Engineering - PHI Publication.
3) I.J.Nagrath and M.Gopal - Control systems Engineering.(New Edition)
4) S.C. Goya! and U.A.Bakshi - Principles of control systems
5) Hadi Saadat - Computational aids in control systems using MATLAB.
6) Kuo, Golnaraghi- Automatic Control System- WSE Willey Publication.
7) Rudra pratap -MATLAB

Suggested Experiments(Min 8 Experiments)

1) To plot sychro characteristics.
2) Determination of transfer function of field controlled D.C. motor
3) Determination of transfer function of armature controlled D.C motor.
4) Determination of transfer function of d.c. genrator.
5) Time response of first order system.
6) Time response of second order system
7) To plot polar plot
8) Bode plot
9) Frequency response of second order system.
10) Study of pneumatic & hydraulic servo mechanism
11) Study of d.c. position control system with and without tachometrtc feedback
12) Assignment on Bode, Nyquist, Root locus , Routh - HURWITZ criterion , time response specifications, frequency response specifications, by using MATLAB (at least 10 assignments)

Note : Students are expected to perform minimum 10 experiments apart from assignment.

S.E. INSTRUMENTATION –PART II

SENSORS AND TRANSDUCERS

Teaching Scheme :-
Lectures: 4 Lecture/week
Practical: 2 hrs / week

Examination scheme :-
Paper:100 marks
Termwork:25 marks

POE :50 marks

SECTION: I

Transducers: 3 hrs.

Definition of transducer, Transducer classification, performance characteristics , errors in measurement and it's statistical analysis, Calibration, Transducer specification, Basic requirement of transducers, Selection of transducers.

Motion, Force, Torque, and Weighing Transducers: 8 hrs

Motion : - Resistive , inductive, eddy current, strain gauge (principle of operation, types, dummy gauge, bridge circuit, advantages, limitation and applications) Electro-optical devices, capacitance type displacement transducers.

Force: - Basic methods of force measurement, elastic force transducers, load cell, LVDT, signal conditioning for LVDT, piezoelectric transducer, dynamic force calibration.

Torque: Strain gauge torque measurement, inductive torque transducers, digital method & magnetostrictive method for torque measurement.

Weighing: Principle, Different weighing transducers, weighing system performance, selection, calibration of electronic load cells.

Velocity, Acceleration and vibration Transducers: - 5 hrs

Tooth rotor Tachometer, photoelectric, stroboscopic dynamometer, mechanical fly ball, angular velocity sensor, translational velocity transducers, Eddy current drag-cup tachometer , absolute velocity seismic pick up, velocity acceleration pick up , digital accelerometer, theory of vibration and acceleration pick up , their calibration, comparison types, jerk meter, application.

Temperature Transducers: 8 hrs

Temperature scales, classification of Temperature sensors, Bimetallic & memory shaped alloy thermometers , filled system thermometers., Resistive Temperature detectors - types , 2 wire & 4. wire method , self heating effect, sensitvily and accuracy considerations, advantages & limitations, comparison of RTD sensors , calibration of Thermometers.

Thermistor - type (NTC, PTC), measuring circuit, calibration & testing, principle & applications.

Thermocouples – Terminology, types (A,B,C,D,E,J,K,R,S,T) and characteristics, laws of thermoelectricity, cold junction compensation methods, Thermo well-thermopile comparison, Thermo couple emf measurement method . Semiconductor Temperature sensors- diode & IC temperature sensors, ultrasonic temperature detector, quartz crystal temperature detector, radiation pyrometers, Pyroelectric infrared sensors.

SECTION-II

Pressure sensors: 5 hrs

Pressure scales & standards, principles, Manometers, digital manometer.

Elastic pressure sensors :- Bellows, bourdon tubes, diaphragm (types, materials, range, sensitivity, construction , advantage & limitations)
High pressure sensors: - dead weight tester, bulk modulus cell, Dynamic Pressure Sensors.
Vacuum Sensors: Mcleod gauge, thermal conductivity ionization type, molecular momentum gauge, penning gauge. Multiple pressure scanner, pressure repeaters.

Flow sensors: 4 hrs

Types, Basic measurement principles. Differential pressure type -Bernoulli's Theorem , variable head type orifice , venturi, pitot tube , flow tube & flow nozzles, variable area type - Rotameter, Turbine type, Target type, magnetic flow type, ultra sonic flow meter, vortex shedding types, thermal flow meter, cross correlation, positive displacement type, anemometers, total flow meters & solid flow meters.

Level Sensors: 4 hrs

Application and selection, Dipstick displacers, float, Bubblers, Conductivity and field effect level switch, Diaphragm level detector, Differential level sensor, float level sensor, Laser level sensor, level guage, microwave level switch, radar Laser, optical level devices, radiation level sensor, Resistance tapes, thermal level sensor, time domain reflectometry and phase differential sensors, Ultrasonic level Detector , vibrating level switch , solid level detectors , Calibration , application & selection

PH, conductivity, viscosity, Density humidity & misc. sensors: 8 hrs.

PH sensors : (Nearest equation & temperature compensation), electrode shapes & design , fiber optic PH delector, solid state type PH sensor, measuring circuits , maintenance and cleaners. Effect of temperature calibration.

conductivity sensors: Principle of conductivity measurement, conductivity cells and probes, measuring circuit, calibration & application.
viscosity sensors: Capillary type, saybolt type, shear's rotating cylinder, cone & plate, falling & rolling ball type viscosometer.
Humidity sensors: Hygrometer (Hair, wire &electrolysis). Dew point meter, piezoelectric humidity meter, infrared, conductance & capacitive type probes for moisture measurement.
Advanced sensors: leak detectors, flame detectors, acoustic & sound level sensors. Proximity sensors (Inductive proximity sensors, Capacitive proximity sensors) Microwave sensors, Laser sensors, (Principle of operation, Features, characteristics, Range & Application) Limit switches Bar code identification system , position Encoder sensors.

References Books:

1. CS.Rangan ,G,R,Shrma , V.S.Mani - Instrumentation Devices and systems -TATA McGrawhill Publication.
2. AJ.Morris - Principles of measurement & Instrumentation - PHI Publication.
3. D.V.S Murthy : Transduers and Instrumentation - PHI Publication.
4. A.K.Ghosh - Introduction to Instrumentation and control - PHI Publication.
5. Sabric Soloman - Sensors and control systems in manufacturing -TATA McGrawHill Publication.
6. Nakra Chaudhry: Instrumentation measurement and analysis
7. A.K.Sawhney : Electrical and Electronic measurement and instrument
8. D.Patrick, Fardo- Industrial Process Control System- Thomson learning Inc.
9. E.O.Doebelin : - Measurement system application and Design IV edition.
10. Patranabis - principle of industrial instrumentation.
11. B.G.Liptak - Process measurement and analysis(Hand book).

Suggested Experiments :

1) Study of LVDT characteristics and its application for displacement measurements
2) Testing & calibration of T,J,K,R,S, Thermocouples
3) Study of strain gauge characteristic, calibration and weight measurement by load cell
4) Determine the RTD Characteristic.
5) Calibration of PT-100.
6) Determine the thermistor characteristic
7) Study of Bellows, Bourdon tube , Diaphragms ^pressure guage and vaccum gauge
8) Study of non-contact type speed sensors like photoelectric pick up and magnetic pick ups
9) To study and test a light dependent resistance Transducer
10) Study of Capacitive pick up for angular displacement measurement
11) To study the linear inductive pickup
12) Study of level transducer (capacitive type).
13) Study of calibration of PH-meter.
14) Study of Flow measurement by
    1) Orifice with manometer
    2) MFM
    3) Turbine meter
    4) Rota meter
15) Study of differential pressure transmitter.
16) Vibration measurement by vibrometer.
17) Study & calibration of conductivity meter.
18) Humidity measurement by psychrometer.

Note: Students are expected to perform minimum 12 experiments

S.E. INSTRUMENTATION –PART II

THERMAL AND FLUID POWER ENGINEERING

Teaching Scheme:-
Lectures : 03 per week
Practical : 2 hrs per week

Examination Scheme :-
Theory Paper :100 Marks
Term work :25 marks

SECTION-I

1) STEAM GENEARTORS:- 3 hrs

Classification, nomenclature, principles and working of low/ high pressure boiler, boiler trial. Function of boilers mountings and accessories. (Descriptive treatment only)

2) STEAM TURBINES AND CONDENSERES: - 3 hrs

Classification, Impulse, Reaction turbines, velocity and pressure compounding, efficiencies, governing of turbines. (Descriptive treatment only)

Functions of condensers, elements of condensing plant, types of condensers, cooling towers. (Descriptive treatment only)

3) AIR COMPRESSORS:- 4 hrs

Uses of compressed air, classification and working of reciprocating air compressor, concept of clearance volume, swept volume, work input, volumetric and isothermal efficiencies. Need of multistage . Rotary compressors - types and applications.

4) INTERNAL COMBUSTION ENGINES:- 4 hrs

Classification. Calculation of IP, BP, BSFC and efficiencies. Heat balance sheet, study of cooling, lubrication, Ignition, starting systems. Modern instrumentation in I.C. Engines.

5) HEAT TRANSFER:- 4 hrs

Various modes of heat transfer, fundamental law of conduction, convection and radiation . Concept of thermal conductivity, heat transfer coefficient. Natural and forced convection. Overall heat transfer coefficient. Types of heat exchangers, fouling factor.

SECTION-II

6) **INTRODUCTION :- 3 hrs**

Fluid properties, density, specific weight, specific gravity, viscosity, compressibility, surface tension, vapour pressure, Newton's law of viscosity, types of fluids.

Types of fluids used in hydraulic - pneumatic ckts, their properties, conditioning, selection.

7) FLUID DYNAMICS AND KINEMATICS :- 7 hrs

Flow visualization, types of flows, one, two and three dimensional, steady and unsteady flow, uniform and non uniform flow, laminar and turbulent flow, rate of flow, continuity equation.

Different types of heads, Bernoulli's equation, Euler's equation, Application of Bernoulli's equation, venturimeter, orifice meter, pitot tube, Reynolds number & Mach number, momentum equation.

8) FLOW THROUGH PIPES:- 4 hrs

Darcy weisbach equation, major and miner losses in pipes, concepts of equivalent pipe, pipes in series and parallel, siphon pipe.

9) HYDRAULIC MACHINES 4 hrs

Basic concept, types of Hydraulic machines, Turbines and pumps, Principle of operation of turbines and pumps. Efficiencies , power, Operating characteristic curves.

Laboratory Experiments.

1) Study of Steam Boilers.
2) Study of Boilers mountings & accessories.
3) Test on Reciprocating Air Compressor
4) Study of various controls used in typical Refrigeration / air conditioning system.
5) Determination of Thermal conductivity of insulating powder and metal rod.
6) Test on computerized I.C.engine.
9) Verification of Bernoulli's Theorem.
10)Calibration of venturimeter / orifice meter.
11)Determination of coefficient of friction in pipes.
12)Test on water turbine.
13)Test on centrifugal pump.

Reference Books

1) P.L.Ballaney - Thermal Engineering.
2) Arora & Domkundowar - Thermal Engineering.
3) Vasandani and Kumar - Elements of Heat Engines
4) Dr. Sukhatme- Heat Transfer.
5) R.K Rajput - Thermal Engineering
6) Dr. Bansal - Fluid Mechanics & Hydraulic machines
7) Dr. Jagdishlal - Fluid machines
8) R.K. Rajput - Fluid machines & Hydraulic machines
9) R.K. Rajput - Heat Transfer.
10) H.L.Stewart — Pneuinatic & Hydraulics.
11) Industrial Hydraulics – Pipenger.

S.E. INSTRUMENTATION –PART II

LINEAR INTEGRATED CIRCUITS

Lectures :- 4 period / week **Paper - 100 Marks**

SECTION - I

1 INTRODUCTION TO OPERATIONAL AMPLIFIERS: 8 Hrs

Definition, symbol and block diagram of operational amplifier including internal circuits and analysis.

OP-AMP parameters and parameter measurements, different offset balancing techniques, ideal op-amp characteristics, equivalent circuit ideal voltage transfer curve, comparative study of various op-amp IC-741,LM 308,LM 324,LM 725,FET OP AMP CA-3140,LF351,LF 358,TL 084.

2 FREQUENCY RESPONSE OF OP-AMP 4 Hrs

Open loop frequency response of 741 limitation of op-amp in open loop condition, closed loop frequency response. roll off rate

3 GENERAL APPLICATIONS OF OP-AMP 8 Hrs

Inverting, noninverting, signchanger, averager, voltage follower, differential amplifiers using one, two opamps. integrator, differentior, precision rectifiers

(half wave & full wave) V TO I & I TO V converters.

SECTION – I I

4 COMPARATOR AND WAVE FORM GENERATOR 6 HRS.

Basic comparator ,comparator characteristics, application of comparator as ZCD, Schmitt trigger, window detector.

Square, triangular and sawtooth wave generator circuit. Sample and hold circuit, peak detector.

5 OSCILLATOR 4 HRS.

Operating principles, Barkhausen's criteria, R.C. Phase shift and wein bridge oscillator using IC741. Limitation of op-amp in oscillator design.

6 ACTIVE FILTERS 4 HRS

Comparision between active and passive filters.

Classification : First and Second order butterwoth filters. Low pass, High pass, Band pass, and band stop. Analysis for cut off frequency and design of filters is expected.

7 STUDY OF FOLLOWING ICS **6 HRS.**

I S.E./ NE 555

II S.E/NE 565 & S.E. / NE 566

III I.C. 8038

IV I.C. 78XX & 79 XX series

Vi μ A 725

Features. Pin configuration, Internal block diagram and applications of above ICS is expected.

EXPERIMENT LIST

1 Study of op-amp
2 General application : A.C. , D.C., Inverting and Non inverting amplifiers.
3 Measurement of op-amp parameters.
4 Summing, Scaling, Subtractor.
5 Study of Integrator and differentiator
6 Study of comparator a) Zero crossing detector b) Schmitt trigger c) Window comparator
7 Study of square wave, Triangular wave, generator circuit using IC 741
8 Study of active filters, a) First and Second order Low pass filter b) First and Second order High pass filter
9 Study of IC 555, a) Astable multivibrator, b) Mono stable multivibrator
10 Study of IC8038

S.E. INSTRUMENTATION –PART II

PROGRAMMING TECHNIQUES - I

Teaching Scheme: **Examination scheme**
Lectures : 2 Hrs/week **Term Work : 50 Marks**
Practical : 2 Hrs/week

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1. Introduction to Software Development:

Software: types, Development Life Cycle 03 hrs.

Operating System: types & functions, Development Environment & tools. Problem Solving: Problem Statements, Problem Analysis, Solution Design, Algorithms & Documentation.

2. Procedure Oriented Programming in C++ 04 hrs.

Concepts: main() function, cin & cout objects, basic data types, variables, declaration & operations.

Selection structures: if-else, if-else chain, switch

Repetition structures: while, for, do while, nested loops

Functions: functions& parameter declaration, function & menu driven program structure. Library functions. Data structures: arrays, pointers, structures Application cases Version 1 & 2 implementations

3. Object Oriented Programming in C++ 06 hrs.

OOP concepts: objects, classes, encapsulation & data abstraction, inheritance, overloading, polymorphism, templates & exception handling.

Classes: abstract data types, constructors, destructors, initialization, copy constructors, array of objects.

Application cases Version 3 implementations

4. Input Output File Stream & data files: File types, File opening and closing, file stream objects & modes, reading & writing files, random file access.

Application cases Version 4 implementations 05 hrs.

5. Graphics Programming in C++ 06 hrs.

Introduction: Display processors, memory & devices, application interface & programming, HMI concepts.

Primitive functions: view port, screen, navigation, pixel, drawing modes & attributes, lines, curves, text, color, fill styles.

Implement simple HMI for process visualization & control.

Practical Guidelines:

Application Cases: Four to Five Real World Problems are selected. Start with simple definitions of the problems implemented as Version 1 solutions. Successive implementation Versions (2...4) will grow in details, complexity & data structures to approach the full solutions. Graphics Applications may consist of independent problems like weather monitoring system, Green house parameters control, Industrial process control systems etc.

Text Books:

C++ for Engineers & Scientists Gary J Bronson PWS

Wait Groups OOP in Turbo C++ Robert Lafore Galgotia

Schaums outline Programming with C++ MGH

C++ how to program Dietel & Dietel PE

Let us C++ Y. Kanetkar, BPB.

OOP with C++ E. Balagurswamy TMH.

S.E. INSTRUMENTATION –PART II

LABORATORY PRACTICE: II

Teaching Scheme: **Examination scheme**

Practical 2 Hrs. / Week **Term work 25 Marks**

P.O.E . 50 Marks

Laboratory practice –II will consist of at least 8 experiments each from subject nos. 1 & 5.

Suggested Experiment from subject No. 1 :-

1) Study of gates(AND, OR , X-OR)
2) Study of NAND ,NOR as universal gates
3) Study of D-Morgans theorem

4) Study of De-Multiplexer
5) Study of Multiplexer
6) Study of Flip-flops(S-R,J-K);
7) Study of counters
8) Study of shift registers
9) Study of 8085
10) 8/16-bit addition
11) 8/16-bit substration
12) Block transfer
13) Block exchange
14) Study of 8255(Mode -0.Mode-1,Mode-2);
15) Study of DAC using 8255
16) Study of stepper motor using 8255

Suggested Experiment from subject No. 5 :-

1 Study of op-amp

2 General application : A.C. , D.C., Inverting and Non inverting amplifiers.

3 Measurement of op-amp parameters.

4 Summing, Scaling, Subtractor.

5 Study of Integrator and differentiator

6 Study of comparator a) Zero crossing detector b) Schmitt trigger c) Window comparator

7 Study of square wave, Triangular wave, generator circuit using IC 741

8 Study of active filters, a) First and Second order Low pass filter b) First and Second order High pass filter

9 Study of IC 555, a) Astable multivibrator, b) Mono stable multivibrator

10 Study of IC8038

SHIVAJI UNIVERSITY, KOLHAPUR

The equivalence for the subject of Instrumentation Engineering at S.E. part-I and S.E. part II Course pre-revised to revised course under the Faculty of Engineering and Technology

Introduced from July 2008

S.E. (Instrumentation) Part –I

Sr. No.	Pre-revised subjects	Sr. No.	Revised subjects
1	Electrical measurement & Instruments	1	Electrical measurement &Instruments
2	Electronic Devices & Circuits	2	Electronic Devices & Circuits
3	Electrical Machines	3	Electrical Machines
4	Circuit Theory	4	Circuit Theory & Analysis
5	Applied Engineering mathematics	5	Applied Engineering mathematics
6	Instrumentation system components	6	Instrumentation system components
7	Laboratory practice-I	7	Laboratory practice-I

S.E. (Instrumentation) Part –II

Sr. No.	Pre-revised subjects	Sr. No.	Revised subjects
1	Sensors & Transducers	1	Sensors & Transducers
2	Feedback control systems	2	Automatic control systems
3	Logic Design	3	Digital systems& microprocessor
4	Thermal & fluid power Engineering	4	Thermal & fluid power Engineering
5	Liner Integrated circuits & applications.	5	Liner Integrated circuits
6	Programming Technique –I	6	Programming Technique –I
7	Laboratory practice-II	7	Laboratory practice-II