M.Sc(Tech) in Instrumentation
(Structure of the 1st and 2nd Semester)
And
Post Graduate Diploma in Instrumentation
(Structure of the 1st and 2nd Semester)

FIRST SEMESTER

Course No.	Title	Theory/Lab Hours per week			Marks		
		Theory	Tutorial	Total Hours	External Exam.	Internal	Total
INS -11	Workshop technology & Mechanism	04	01	05	70	30	100
INS -12	General electronics	04	01	05	70	30	100
INS -13	Measurement techniques	04	01	05	70	30	100
INS -14	Optical and Analytical instumentation	04	01	05	70	30	100
INS -15	Practicals W – 1, E - 2	09	01	10	140	60	200

SECOND SEMESTER

Course No.	Title	Theory/Lab Hours per week			Marks		
		Theory	Tutorial	Total Hours	External Exam.	Internal	Total
INS -21	Metrology	04	01	05	70	30	100
INS -22	Microprocessors	04	01	05	70	30	100
INS -23	Measurement systems	04	01	05	70	30	100
INS -24	Biomedical and Environmental Instrumentation	04	01	05	70	30	100
INS -25	Laboratory work W – 1.E – 1 Transducer & Sensor Lab	09	01	10	140	60	200

DISTRIBUTION OF INTERNAL MARKS :

For each Theory Papers	Marks
1. One Test per Semester	15
2. One Tutorial per Paper Semester	10
3. One Assignment per Semester	05
Total	30

For laboratory Course per semester	Marks
1. One Test	40
2. journal/report writing	20
Total	60

Workshop technology & Mechanism

Unit – 1.3256
Materials for Instruments, bearings, machine bearing; Use of instruments bearings, different types of bearing and guides.

Unit – 2
Brief introduction to steps, couplings, clutches, joining and functional mechanisms.

Unit – 3
Elements of workshop technology covering fundamentals of simple manufacturing processes

Unit – 4
Machine tools like lathe, drilling, milling and shaping machines. Measuring systems and precision instruments. Measuring with sclae, Mathematical concepts, Limiting means, range, variance, Standard deviation, normal distribution, continence intervals. Principals of sampling.

Unit – 5
Alignment testing. Machine tools alignment, machine beds. Alignment of axis (spindle axis and bed, spindle axis and line of centers).

Unit – 6
Axial slip and calibration of lead screw, alignment telescopes. Interferometers. Elerosonic pulse-Echo and resonance gauging. optical alignment. Equipment and methods.

RECOMMENDED BOOKS

1. **Elements of Precision Engineering :R. Raman Oxford & IBM Pushlishing Co.,New Delhi - Bombay - Calcutta.**

2. **The Design and use of Instrument and Accurate Mechanism :White head, T.N. Dawn Publication Inc.**

3. **Engineering Metrology : R.K.Jain,Khanna Pub.Delhi 1973**

Semester-I
PAPER - INS-12
General Electronics

UNIT-1
Typical electronic systems, classification of electronic systems and devices. junction diode, zener diode, voltage regulator, special purpose diode rectifiers, filters, JFET,MOSFET,BJT integrated devices and circuit manufacture, transistor and intergrated circuit biasing, basic design. AC gain, input output impedances, some special circuit.

UNIT- 2
Darlington pair, feedback, single and multi stage amplifiers. cascade amplifier, frequency response, amplifier classes, complementary symmetry circuits. new power transistor type of feed back circuits, effects of feedback on impedance, negative feedback circuits, stability in feedback amplifies, oscillation operation, UJT oscillator, PLL

UNIT- 3
Basic operational amplifier OPAMP circuits, applications of OPAMPS linear and non-linear applications of OPAMP system of numbers, binary. octal, hexadecimal, BCD, Gray code, ASCII code conversion pvm one system to another.

UNIT- 4
Positive and negative logic, different logic gates, their symbols and truth tables, introduction to different logic families, TTL,ECL,CMOS, I C. merits and demerits.

UNIT-5
K-Map and its application, binary adders,full adders, full adder as a subs tractor, arithmetic functions. decoder demultiplexer. data selector multiplexer, encoder, ROM , applications of ROM .

UNIT- 6
1 bit memory, flip-flops, shift resistors, synchronous counter, asynchronous counter, applications of counter. RAM tristate buffer and multiplexed display system, A to D, D to A converters.

RECOMMENDED BOOKS

1.   Nagraths : Electronics, Analog and Digital

2.   Millman and Halkias, Integrated Electronics, McGraw Hill

3.   Millman and Grabel, Microelectronics, McGraw Hill

Semester-I
PAPER - INS-13
MEASUREMENT TECHNIQUES

UNIT-1

Generalized measurement system,Basic Concepts in dynamic measurements,System response Impedance matching.

UNIT- 2

Causes & types of experimental errors, Uncertainty analysis,Evaluation of uncertainties for complicated data reduction,Statistical analysis of experimental data,Probability distributions,Gaussian error distribution,Chi-Square test of Goodness of fit,Method of least Squares,Correlation coefficient.

UNIT- 3

Transducer,Transducer characteristics,Selection of an instrumentation transducer,Transducer as an electrical element,Modelling external circuit components, circuit calculations,Measurement methods.

UNIT- 4

Variable – resistance transducer,Differential transformer (LVDT),Capacitive transducer,Piezoelectric transducer,Photoconductive transducer,Photovoltaic cell,Ionization transducer,Hall effect transducer,Magnetometer search coil,Digital displacement transducer.

UNIT-5

Temperature transducers,stress & strain,strain measurements,Electrical – Resistance strain gages, Measurement of Resistance strain - gage outputs, Temperature Compensation,Strain-gage Rosettes,unbonded Resistance strain gage.

UNIT- 6

Signal to noise Consideration, Noise in the frequency domain, Sources of noise, Signal to noise & experimental design, Frequency & bandwidth considerations, Bandwidth control,Signal – to – noise enhancement,Digital correlation & autocorrelation methods.

RECOMMENDED BOOK

(1) M.Sayer & A Mansingh

   Measurement,Instrumentation and Experiment Design in Physics and Engineering,PHI 2000

(2) J.P.Holman

   Experimental Method for Engineers,7th Edition, McGraw Hill,1990

(3) E.O.Deoblin

   Measurement systems,Applications & Design,McGraw Hill,1990

(4) C.S.Rangan,G.R.Sarma,V.S.V.Mani

   Instrumentation Devices and systems, McGraw Hill,1983

(5) A.K.Sawhney

   A course in electrical and electronics measurements and instrumentation,Dhanpat Rai & sons,

   1998

Semester-I
PAPER - INS-14
Optical & Analytical Instrumentation

UNIT-1
Laser, Introduction, Absorption, of Light, Spontaneous & stimulated emission, Einsteins coffecient population inversion, Pumping processes, Light amplification, threshold conditions, Laser rate equations for three level & four level systems, properties of laser light: coherence,Directionality.

UNIT- 2
Types of lasers : Ruby laser, Neodymiam lasers, (Nd : YAG, Nd : Glass), He – Ne laser, Argon – ion laser, CO_2 laser, Dye laser, Semiconductor lasers, Applications of lasers in Material processing, Laser tracking, Lidar, Length measurement, velocity measurement & holography.

UNIT- 3
Fiber optics, Comparison with conventional metallic fibers, Step index & Graded index fibers, Introduction to fiber propagation using ray model, material dispersion, Combined effect of multipath dispersion & material dispersion, Fiber materials, Fiber fabrication process.

UNIT- 4
Optical Sources : Laser diodes, Light source linearity, Source – to – fiber power launching, Fiber – to- fiber joints, Splicing techniques, Optical fiber connectors, Photodetectors : Physical principles of photodiodes, Applications of Fiber optics:Medical application, Lightwave communication

UNIT-5
Electron structure of atoms, X – ray fluorescence line spectra, Fine structure, Absorption & emission processes, Production of X – rays, X –ray diffraction & crystallography, Neutron diffraction, Transmission electron microscopy, Surface analytical methods, Nuclear techniques, Atomic force & tunneling Scanning microscopes.

UNIT- 6
Spin resonance spectroscopy : Nature of spinning particles, interaction between nuclear spin & a magnetic field, Larmor precession, Nuclear magnetic resonance, Chemical shift, Relaxation meachanisms, Experimental study of NMR, Electron spin resonance, Hyperfine structure of ESR absorptions, Fine structure in ESR spectra, Double resonance in ESR, Mossbauer spectroscopy, Applications of Mossbauer spectroscopy.

RECOMMENDED BOOKS
(1) A.K.Ghatak & K. Thyagarajan, Optical Electrinocs,
    Cambridge University press,1990
(2) K. Thyagarajan & A.K.Ghatak
    LASERS,Theory & Applications, Macmillan (India),1984
(3) G.Keiser
     Optical fiber communications, McGraw – Hill,1983
(4) J.Gowar
    Optical communication systems, PHI,1987
(5) M.Sayer & A.Mansingh
    Measurement, Instrumentation and Experiment Design in Physics and Engineering, PHI ,2000

Semester - I
PAPER – INS - 15
Workshop technology & Mechanism

Lab: 1   **(03 hours/week)**
Group: B   **MECHANICALS LAB**

(1) Filing practice
(2) Turning practice - I
(3) Turning practice – II
(4) Shaping practice
(5) Grinding practice
(6) Milling practice – I
(7) Milling practice – II
(8) Gear cutting practice
(9) Alignment with maintenance

PAPER – INS -15

ELECTRONIC LAB

Lab : 2   **ELECTRONIC LAB**   **(06 hours/week)**
Group : A

(1) Familiarization with various active & passive components

(2) Development of soldering skill & making of PCB

(3) To design, build & test Half adder & Half substractor

(4) To design, build & test UJT Oscillator

(5) To design, build & test inverting & non – inverting amplifier using IC 741

(6) To design, build & test Full Adder & Full substractor

(7) To design, build & test integrator & differentiator circuit using IC 741

(8) To design, build & test stable muitivibrator

(9) To design, build & test colpit's oscillator

(10) To design, build & test a 4 – bit binary up counter using J – K flip flops

(11)To design, build & test digital to analog converter

(12) To design, build & test a single stage RC coupled amplifier

Metrology

Unit - 1
Standards of measurenments, standards of length, end standards, Vernier callipers, fixed gauges, inside, depth and height gauges, Gauge blocks surface plates. micrometcs. Angular measurement sine bars, angle gauges, levels, clinometers, auto collimations, taper gauge.

Unit - 2
direct measuring tools and instruments, Optical projectors and microscopes, Horizontal vertical and cabiner profile projector, Toolmakers and workshop microscopes, End standards, end bars, slip gauges.

Unit - 3
Comparison measurements: Comparators, pneumatic, electric and electronic comparators. Limits, Fits and Tolerances. Interchangeability, types of fits geometric dimensioning and tolerance. Interference.

Unit – 4
Surface characteristics, Evaluation and symbology, Surface roughness measurements, profilometers.

Unit – 5
Surface texture measurements and gauging.

Unit - 6
Management of inspection and quality control, Automatic dimensional controls manufacturing processes.

RECOMMENDED BOOKS

1. **Elements of Precision Engineering : R. Raman, Oxford & IBM Pushlishing Co., New Delhi - Bombay - Calcutta.**

2. **The Design and use of Instrument and Accurate Mechanism : White head, T.N. Dawn Publication Inc.**

3. **Engineering Metrology : R.K.Jain, Khanna Pub.Delhi 1973.**

Semester-II
PAPER - INS-22
MICROPROCESSORS

UNIT-1
What is microprocessor, need for microprocessor in instrumentation advantage of microprocessor in instrumentation.

UNIT- 2
Microprocessor Architecture, Introduction, Registers, concept of data, address and data buses, memory (RAM, ROM and EPROM) input output devices, Microcomputer systems.

UNIT- 3
Instructions, Timing and Programming Methods, Instruction set and classifications, timing diagrams, fetch and execute cycles, addressing modes, assembly language programs, single stepping and single cycle utility routines in microprocessors kits, simple programming techniques like looping, counting, indexing, sub-routines, parameter passing and software time delays.

UNIT- 4
Data transfer Techniques, Synchronous and asynchronous data transfer, polling, incrrupt driven data transfer, masking of interrupts, serial data transfer, direct memory access, data transfer, timing cycles, op-code, fetch cycle, memory and I/O read and write cycles.

UNIT-5
Parallel input/output and interfacing applications, Basic interfacing concepts, Interfacing of memory chips, Interfacing with seven segment display and keyboard.

UNIT- 6
General purpose peripheral devices block diagram, pin configuration and operating modes of 8251, 8254,8255,8259, 8279 (or their currently available functionally equivalent/upgrade) and DMA controller asynchronous receiver / transmitter (UART) etc. interfacing these chips to 8085
DAC & ADC : DAC & ADC chips and their interfacing.
Higher bit chips, brief description of 6800/ 68000 series, 8086,8088,80286, 80386, 80486 Pentium and other higher bit chips.

RECOMMENDED BOOKS

1.   R.S. Gaonkar, Microprocessor, architecture, programming and Applications,

        Penran International 1997.

2.   Mathur, Introduction to Microprocessors,

3.   B.B.Bray, Microprocessors Architecture programming and PHL 1997.

4.   B.Ram, Fundamentals of microprocessors 2000.

Semester-II
PAPER – INS - 23
MEASUREMENT SYSTEMS

UNIT-I
Measurement of Displacement force torque and speed.

UNIT-II
Methods of pressure measurement. Measurement of vacuum , electrical pressure transducers pressure switches.

UNIT-III
Calibration, maintenance and repair of pressure measuring instruments liquid, level measurements. Electrical methods, capacitance level, Indicator radiation level indicator, servicing of level measuring instruments.

UNIT-IV
Temperature measurement methods of temperature measurement, Expansion and filled system thermometers electrical temperature instruments, parameters.

UNIT-V
Characteristics of vacuum. Vacuum system vacuum pumps gauges. Pumping speed for a vacuum system, thin film techniques, film thickness measurements and monitors.
1.   IEF 488 interfaces bus instrumentation software.
2.   Recorders, Automatic controllers and tele-metering systems. Digital Voltmeter and multi-meters polarography, photovoltaic cell, light emitting diodes.

UNIT-VI
Signal to noise consideration, noise in frequency domain, sources of noise, signed to noise in experimental design, frequency and bandwidth consideration, bandwidth control, signal to noise enhancement, digital correlation and auto correlation methods, signal recovery, signal filtering, signal averaging, signal coding.

RECOMMENDED BOOKS

1. M.Sayer and A.Mansingh, Measurement, Instrumentation and experimental design for physics and engineering PHI, 2000.
2. B.E.Jones, Instrumentation. Measurement and control. TMH 1981.
3. A.K. Sawhney, A Course in electrical and electronics measurements and instrumentation. Dhentat Rai and Sons. 1998.
4. C.S. Rangan G.S. Sharma, V.S.Mani. Instrumentation Devices Systems, TMH,1983, (1998)
5. J.P. Holman, Experimental Systems, applications and Design, M.C. Grow Hill 1990.
6. F.O.Deoblin Measurement Systems, applications and design, Mc Gro Hill , 1990
7. A.J.Difender, Principles of electronic instrumentation. W.B. Saunders (toppan) 1972.
8. S.K.Singh, Industrial Instrumentation and Contrl, TMH 1990.
9. D.Patranabis, Principals of Industrial Instrumentation, TMH 1996
10. J.Jha, M.Puri, R.S.Kanav, M.Kasav.
    Elements of Electronic Instrumentation, Narosa. 1996.

Semester-II
PAPER - INS-24
Biomedical and Environmental Instrumentation

UNIT-1
Electrodes, Sensors & Transducers:

Sensor error sources, Tactics & signals processing for improved sensing, Electrodes for biophysical sensing, Medical surface electrodes, Microelectrodes, Inductive transducers, Temperature transducers.

UNIT- 2
Electrocardiographs ECG waveform, other ECG signals, ECG preamplifier, ECG readout devices, ECG machine, ECG machine maintenance, ECG faults & troubleshooting.

UNIT- 3
Electroencephalography

EEG Electrodes, EEG amplitude & frequency bands EEG diagnostic uses and sleep patterns, EEG system : simplified block diagram, preamplifiers & EEG system specifications, Typical EEG system artifacts, faults, troubleshooting and maintenance.

UNIT- 4
Blood pressure measurements, Oscillometric and ultrasonic noninvasive pressure measurements
Direct methods : H_2O manometers, pressure amplifier designs, systolic, diastolic and mean detector circuits.

UNIT-5
Defibrillators, Defibrillator circuits, Cardioversion, Pacemakers, Heart – lung machines, ICU equipment, Bedside monitor circuits, Central monitoring consoles.

UNIT- 6
Environmental Instrumentation
Air – pollution standards, General air – sampling train, Gas sampling techniques, Particulate sampling techniques, SO_2 measurements, Combustion products measurements, Opacity measurements : Odor measurements, Water quality by turbidity meter, Calorimeter, PH meter.

RECOMMENDED BOOKS

(1) Joseph J. Carr, John M. Brown

Introduction to Biomedical equipment Technology Fourth Edition, Pearson Education,2001

(2) J.P.Holman

Experimental Methods for Engineers : 7th Edition , THM, 2001

(3) L. crimwell, F.J.Weibell, E.R.Pfeifter

Biomedical Instrumentation and Measurements, PHI,1980

Lab : 2   (**03 hours/week**)

ELECTRONIC LAB

(1) To design, build & test Wein bridge oscillator using IC 741

(2) To design, build & test 4 – bit binary down counter using J.K.Flip flops

(3) To design, build & test A to D converter

(4) To design, build & test Voltage regulator using IC 741

(5) To design, build & test (i) 4 X 1 multiplexer (ii) 1X 4 demultiplexer

(6) Writing & testing the following assembly language programmes :

   (i) Arrange the data stored in some location in ascending / descending order

   (ii) Multiple precision addition & substraction

(7) To design, build & test (i) BCD to Excess – 3 code converter (ii) Excess -3 to

   BCD code converter.

Lab : 3   (**03 hours/week**)

TRANSDUCER & SENSORS LAB

(1) Study of LVDT & Strain gauge

(2) Study of Speed measurement

(3) Study of R.T.D. Characteristics

(4) Study of Thermistor and Thermocouple

(5) Study of inductive pickup and capacitive pickup

(6) Study of Piezoelectric transducer

(7) Study of LDR

Lab   **(03 hours/week)**

MECHANICAL LAB

(1) To find angle of V-block using rollers and depth micrometer.

(2) To measure angle of taper of internal dovetail, using rollers, bevel protractor and

     slip gauges.

(3) To measure angle of taper of external dovetail, using rollers, bevel protractor and

     slip gauges.

(4) To determine the radius of circular arc, using rollers.

(5) To measure angle of taper of internal dovetail, using rollers and length measuring

     instrument.

(6) To measure angle of taper of internal dovetail , using rollers, bevel protractor

     and slip gauges.

(7)   To determine the radius of circular arc, using rollers.

(8) To calibrate given Gear Tooth Vernier.

(9) To trace the tooth profile of given gear specimen.

(10) To get module (m) by base tangent method & other parameter's such as p.C.D.

     (D), Outer dia (Do), Root dia. (Di), depth of tooth (ht) etc.

(11) To calculate tooth thickness at pitch circle & at constant & to verify the same

     from trace of the tooth profile.

THIRD SEMESTER

Course No.	Title	Theory/Lab Hours per week			Marks		
		Theory	Tutorial	Total Hours	External Exam	Internal	Total
INS -531	Electrical Machines & Power Electronics	04	01	05	70	30	100
INS -532	Integrated circuits and its Applications in Instrumentation	04	01	05	70	30	100
INS -533	Fundamentals of C Programming	04	01	05	70	30	100
INS -534	Process Instrumentation - I	04	01	05	70	30	100
INS -535	Laboratory INS 103	06		06	140	60	200

FOURTH SEMESTER

Course No.	Title	Theory/Lab Hours per week			Marks		
		Theory	Tutorial	Total Hours	External Exam	Internal	Total
INS -541	Advanced Electrical Machines & Control of Drives	04	01	05	70	30	100
INS -542	Electronic Instrument and instrumental System design	04	01	05	70	30	100
INS -543	Instrumentation system Design using Microcontroller	04	01	05	70	30	100
INS -544	Process Instrumentation - II	04	01	05	70	30	100
INS -545	Laboratory INS 203	06		06	140	60	200

DISTRIBUTION OF INTERNAL MARKS :

For Each Theory Papers	Marks
1.One Test per paper Semester	20
2.One Paper Per Semester	05
3.One Assignment per Semester	05
Total	30
For Laboratory Course per semester	Marks
1. One Test	40
2. Journal / Report writing / Seminar	20
Total	60

Semester-III
PAPER – INS - 531
Electronic Machines & Power Electronic

Unit – 1 D.C. Machines / A.C. Machines

Construction, Working Principle - Generator & Motor, Types & characteristics - Generator & Motor, emf equation, Numericals, Back emf, Numericals, Torque, Speed control Starters – Motor, Braking of DC Motor Applications - Generator & Motor.
Construction, Working Principle – Alternator, types, emf equation, Synchronous Motor - working principle, Starting Methods, 'V' – curves, Applications.

Unit – 2 Induction Motor

Three phase Induction motors - Construction, Types, Slip, Torque equations, characteristics, Application, Starting methods, Speed control Methods, Braking of IM, Single phase IM, Types, Universal Motor.

Unit – 3 Contactors & Relay

Basics of Contactor, Types, N.O. and N.C. Configurations, applications, Pressure switch, Pneumatic valves, Relays – basics, Use of Relay in Motor starters, MCC - their applications.

Unit – 4 Modern Power Semiconductor Devices

Thyristor, Serise and Prallel operations of Thyristors, Diac, Triac, Phase Controlled, Inverter grade and Asymmetrical. Thyristors, Rct, GATT, SUS, SBS, LASCR, Power Transistors, Power MOSFETs , IGBT, SIT, GTO,- Latching Transistor-FCT, SITH, MCT, PIC.

Unit – 5 Phase controlled Rectifiers of Converters

Principle of Phase Control, Full Wave controlled Converters, Single phase Full wave Converters, Single phase Two-Pulse Converter Systems using Diodes, Three-phase Thyristor Converter Circuits, Effect of Source Impedance on performance of Converters, Dual Converters, Practical Dual Converter.

Unit – 6 Inverters / Choppers

Single-phase Voltage Source Inverters Operating Principle, Fourier Analysis of Single-phase Inverter output Voltage, Force - Commutated Thyristor Inverters, Three-phase Modulated Inverters, Reduction of Harmonics in inverter output voltage, current source inverters, Series and Parallel Inverters.

Principal of chopper Operation, control Strategies, Step-up choppers, Types of choppers circuits, Steady State Time-domain Analysis of Type -A chopper, Thyristor chopper circuits, Multiphase choppers.

➢ REFERENCE BOOKS :

1. Electrical Technology Vol. – II -- B.L.Theraja.

2. Electrical Machines – Nagrath & Kothari.

3. Control System components by Deltoro.

4. SCR and TRIAC by Rammurthy.

5. Power Electronics- P.C.Sen.

6. Power Electronics- P.S.Bimbhra.

7. Power Electronics- singh and Khanchandani.

8. Power Electronics - Circuits Devices and Application – M.H. Rashid

9. Thyristor Engineering – M.S.Berde.

10 Power Electronics – C.W.Lender.

Semester-III
PAPER – INS - 532
Integrated Circuits and its applications in Instrumentation

Unit 1. General Linear Applications

DC and AC amplifiers, AC amplifiers with single supply voltage , peaking amplifier, Summing , Scaling and Averaging amplifier, Instrumentation amplifier – its block diagram along with applications, Differential input and differential out put amplifier, Voltage – to- current converter with floating load (low – voltage DC Voltmeter , low – voltage AC voltmeter , Diode match finder , Zener diode tester , Light – emitting diode tester), Current – to- voltage converter , Very high – input impedance circuit , Integrator, Differentiator.

Unit 2. Active Filters

First order and second order low pass and high pass Butterworth filter, band ,pass
and band rejected filters , Notch filter, All pass filter

Unit 3. Timer IC and its applications

Introduction , features , terminals , Time on delay application ,555 timer as Astable Multivibrator , Design procedure , Application as a Square wave Oscillator and Free – running Ramp generator , 555 Timer as Monostable Multivibrator Design procedure , applications as pulse stretcher and frequency divider.

Unit 4. Data acquisition and conversion

Analog single processing - sample and Hold circuit , sampling theorem, Analog
Mux and analog channel expansion , Data Logger

Unit 5. Non Linear Signal Processing

Introduction , Amplifier Modulation and Demodulation , amplitude modulation ,
Nonlinear modulation , Bandwidth of Angle – Modulated waves , Generating FM waves ,
Demodulation of FM signals

Unit 6. Fiber Optical Sensors

Introduction , Requirement of fiber optical sensor , Merits and Demerits over conventional sensors . Current sensor, Gyroscopic sensor , Rotation sensoer

REFRENCE BOOKS :

1. Kalsi H.S. electronic Instrumentation
2. Electronic Communication by Roddy & John Coolen IV EDition PHI
3. Ramakant Gayakwad ; Op Amps and Linear Integrated Circuits, Pearson Education PHI
4. Coughlin and Driscol :Op Amps and Linear Integrated Circuits,6th edition
5. SCHINIER , " Fiber Optical Communication

Semester-III
PAPER – INS - 533
Fundamentals of 'C ' Programming

Unit-1

   Introduction to C, features of high level language, Operators & Data types.

Unit-2

   The Decision control structure : if statement, if… else statement, nested if statements, if… else if… statements. Case control structure: Switch statement, go to statement, and break statement.

Unit-3

   Loop control structure: entry control and exit control loop, for loop, while loop, do-while loop.

Unit-4

   Array, one dimensional array, two dimensional array, string processing

Unit-5

   Functions: library function, user defined functions, reentrant function, recursive function.

Unit-6

   Pointers and Structures , Introduction I/o handling

Suggested List of experiments :-

   1. Introduction to software development tools, editor, compiler, linker, debugger etc.
   2. Programs based on operators and input/output library function
   3. Programs based on loops
   4. Programs based on one, two dimensional array.
   5. Programs based on string processing.
   6. Programs based on user defined functions
   7. Programs based on array
   8. Programs based on pointer and structure

Reference Books:

   1.   Let us C by Kanetkar.
   2.   Programming in C by Balaguruswami.
   3.   Programming in C by Byron Gottfrid.
   4.   Fundamentals of computers of programming by Jeenwala & Patel

Unit -1

Process characteristic: Types of processes, constant step analysis method of finding time constant, dead time, dynamic elements in control loop, single and multicapacity processes

Unit -2

Control Actions:
Flow, pressure, level, temperature, composition, ph, etc, P, PI, PID control action, comparison, Controller Tuning methods

Unit -3

Multiloop and multivariable process control systems:
On-Off control system, feedback control, feed forward control, cascade control, ratio control, Selective control, Optimization control system, Computed variable system

Unit -4

Process instrumentation for heat exchangers, evaporators and drivers, steam boilers, reactors, pumps, compressors and furnaces, discrete and regulatory controls, safely interlocks for batch control system**.**

Unit -5

Standard symbols & Instrumentation Diagrams:
Line symbols, Field mounted and Panel mounted symbols, Process equipment symbols

Unit -6

Important Engineering Drawing:
Loop Diagrams, Wiring diagram, P&I Diagram, Process Flow sheet, Etc.

REFERENCE BOOKS :

1   Industrial instrumentation:
        Principles and Design by T.R.Padmanabhan
2   Industrial Industrumentation by Eckman
3   Process control system 3/e by F.G.Shinskey, Mc Graw Hill
4   Chemical process control, introduction to theory & practice by G.Stephanapoulos, Prentice Hall.
5   Instrumentation for process measurement & control 3/e by N.A. Anderson, Chilton Bk, Co.
6   Process control (instrument engineers Hand book) by Liptak, Cinton Book Co.

Semester-III
PAPER – INS – 535
Laboratory Session INS – 103

Group – A

1.   Study of Construction of DC Machine.

2.   Study of Construction of Synchronous Machine.

3.   Study of the Characteristics of Induction Motor.

4.   Study of the characteristics of SCR.

5.   Study of the characteristics of TRIAC.

6.   Study of the characteristics of a power MOSFET.

7.   Study of the characteristics of IGBT.

8.   Study of the characteristics of D.C. Motor.

9.   Study of speed control circuit of D.C. Motor.

10. Study of Induction Motor Starters.

Group – B

1.   Study of the Phase controlled circuit.

2.   Study of the converter circuits.

3.   Study of the inverter circuits.

4.   Study of AC Drives.

5.   Study of DC Drives.

6.   Study of Synchro transmitter and receiver system.

7.   Microprocessor based controlled A.C. Motor.

8.   Study of types of Earthing systems.

9.   Study of Cable construction.

10. Study of speed control circuit of Induction Motor.

Semester-IV
PAPER – INS - 541
Advanced Electrical Machines & Control Drives

Unit – 1 Protection of Motors

Sequencing and Interlocking, Staring, stopping, emergency shut down of motor systems, Starting of Induction motor in full load both directions, starting with variable speeds, protection circuits.

Unit – 2 Advance Electrical Machines / Synchros

Stepper Motor, Construction, Working Principle, Transfer Function, Microprocessor interfacing circuits and Applications.Servo Motor, Construction, Working Principle, types, Applications. PMDC, PMBLDC - Construction, Working Principle. Synchrous - types, Construction, Working Principle, Applications**.**

Unit – 3 Cable / Electrical Safety

Cable – types, Construction, Specifications, Applications, Trouble shooting procedure, analysis and modifications.
Types of Elecrical hazards, Electrical safety in electrical circuits, Fundamental safety rules, Electric earthing, types of Earthing.

Unit – 4 Cyclo-converters

Principle of cyclo-converter operation, Single-phase to Single-phase circuit-step-up cyclo-converter, Single-phase to Single-phase-Step-down Cyclo-converter, Three-phase Halt-wave Cyclo-converters.

Unit – 5 Control of D.C. Drives

Basic Machine Equations, Braking Modes, Schemes for D.C. Motor speed Control, Single –phase Separately Excited Drives, Braking Operation of Rectifier Controlled Separately Excited Motor, Power factor improvement, Three-phase separately, Excited Drives, D.C. Chopper Drives, Close-loop Control of D.C. Drives, PLL Controls of D.C. Drives, Microcomputer Control of D.C. Drives.

Unit – 6 Control of A.C. Drives

Basic Principle of Operation, Squirrel cage Rotor Design, Speed Control of Induction motors, Stator Voltage Control, Variable Frequency control, VVVF IM Drive, Rotor resistance control, Slip power recovery Scheme, Synchronous Motor Drives, Microprocessor Controlled A.C. Drives.

REFERENCE BOOKS :

1)   Electrical Technology Vol. – II -- B.L.Theraja.
2)   Electrical Machines – Nagrath & Kothari.
3)   Electrical Power System – V K Methta.

4)   Power Electronics- P.C.Sen.
5)   Power Electronics- P.S.Bimbhra.
6)   Power Electronics- Singh and Khanchandani.
7)   Power Electronics - Circuits Devices and Application – M.H. Rashid.
8)   Thyristor Engineering – M.S.Berde.
9)   Power Electronics – C.W.Lender.
10) Variable speed drives (ISA)
11) Electrical Drives – G. K. Dubey.

Semester-IV
PAPER – INS - 542
Electronic Instrumentation and instrumental system design

Unit 1. Oscilloscope

Criterion   for oscilloscope, Basic oscilloscope , special oscilloscope , Dual beam oscilloscope , Dual trace oscilloscope , Digital Storage oscilloscope , oscilloscope Probes

Unit 2. Signal Generators

Criterion for oscillation , sine were generator , square wave generator , Triangular wave generator , Basic signal generator , Special signal generator , Function generator , Sweep generator

Unit 3. Digital Instruments

Introduction ,   Digital voltmeter, Ramp type digital voltmeter , Dual slop type digital voltmeter , Integrating type digital voltmeter , concept of half digit, Digital measurement of frequency and time, digital frequency meter, digital measurement of time

Unit 4. Wave from Analyzer

Basic wave analyzer , frequency selective wave analyzer, heterodyne , spectrum analyzer , harmonic distortion analyzer , harmonic distortion using resonance bridge and wein bridge

Unit 5. Digital Transmission Technique

Introduction to data transmission techniques, advantage and disadvantage over analog techniques , TDM and FDM , pulse Modulation techniques, PCM,DM, ASK, FSK, PSK and their application to instrumentation

Unit 6. Reliability Engineering

Reliability, MTBF , concept on available component screening , infant mortality and bath tub curve, component aging , Failure rate analysis

REFRENCE BOOKS :

1.Kalsi H.S. electronic Instrumentation
2.Electronic Communication by Roddy & John Coolen IV EDition PHI
3.Reliability Engineering by E. Balaguruswami
4. Ramakant Gayakwad : Op Amps and Linear Integrate Circuits , Pearosn Education 4/e

Instrumentation System Design Using Microcontroller

Unit - 1 Introduction to 8051 Microcontroller

Introduction, Difference between Microprocessors and Microcontrollers. Overview of 8051 Microcontroller family, Introduction to different microcontroller families (PIC,AVR,ARM), Advancements in 8051 architecture like Infineon - XC88X, SiLabs-C8051F12X(CIP 51 core)

Unit - 2 Architecture of 8051 Microcontroller

Introduction, 8051 microcontroller hardware, Pin diagram of 8051, input/output pins, ports and circuits. Internal RAM and ROM , SFR's, interfacing with external memory, timers and counters, interrupts.. Serial data communication (UART).

Unit - 3 8051 Assembly language programming

Assembler directives, Addressing modes, data transfer instructions, Logical instructions, Arithmetic instructions, Branching (Jump & Call) instructions, Bit addressable instructions and special instructions, Interrupts and interrupt
handler sub routines (Interrupt Service Routines).

Unit - 4 8051 programming in embedded C

Introduction, Date types in embedded C, arithmetic and logical operators,Control statements and loops in embedded C, Functions and Arrays in embedded C. Programming of input/ output ports, Programming of Timer
& counters, writing interrupt service routines in Embedded C,Programming of UART and PCA Timer in embedded C.

Unit - 5 Hardware Interface

Introduction, Interfacing and C programming of 8051 with keyboard,Interfacing and C programming of 8051 with 7-segment display, Interfacing and C programming of 8051 with LCD display, Interfacing and C programming of 8051 with ADC-DAC and sensors, SPI and I2C serial communication protocols and their programming.

Unit-6 Applications and design of microcontroller based systems

Relay and optoisolators, Emergency Alarm System, stepper motor control, Temperature Control system, Traffic Light Control System, Weight Measurement, SCR firing circuit, DC motor interfacing and PWM.

Suggested List of experiments:-

1. **Introduction to Program development tool Chain using μVISION3**:
   Integrated development Environment (IDE), editor-assembler, compiler,
   linker, simulator, and debugger. Assembly and 'C' program development and
   debugging process.

2. Assembly language programming for addition, subtraction, multiplication and
3. division of two 8-bit numbers.
4. Assembly language programming for block data transfer between internal and
5. external memory including overlapping blocks. Occurrence of number from a set of
   data. Binary to BCD, Binary to ASCII code conversion, separation of odd/even,
   +ve/-Ve Numbers from a set of data
6. Assembly language programming for Timers in different modes.
7. I/O port programming in embedded C.
8. Timers and Counters programming in embedded C for time delay using ISRs.
9. Traffic Light Controller programming in embedded C
10. Digital clock programming using 7- segment display in embedded C.
11. Programming of LCD in embedded C.
12. Programming for Frequency Measurement and display on LCD display in Embedded
    C
13. Programming of keyboard in embedded C.
14. Serial communication and UART programming in Embedded C.
15. Programming of parallel ADC and DAC in embedded C.

Text Books:

1. The 8051 Microcontroller Architecture, Programming & Applications by Kenneth J.
   Ayala(Penram International)
2. The 8051 Microcontroller and embedded systems using Assemble and C. by
   Muhammad Ali Mazidi and Janice Gillipse Mazidi (Pearson Education)

References Books:

1. The 8051 Microcontroller & Embedded systems using Assembly and C. by K.J.
   Ayala, D.V. Gadre (Cengage Learning, India Edition)
2. Programming and Customizing the 8051 Microcontroller by Myke Predko (Tata
   Mcggraw Hill).
3. 8051 Microcontrollers: MCS51 family and its variants by Satish Shah, Oxford
   University Press.
4. www.infineon.com www.silabs.com

Unit – 1 Control Valve:

Introduction, Common abbreviations in the valve industry, Definitions of terms associatedwith valves, Control Valve characteristics, Valve classifications & types, Selection criteria forcontrol valves

Unit – 2 Control Valve Accessories:

I/P convertor, Positioners, Limit Switches, Hand-wheels, Lock up Relay, Solenoid Valves, Booster Relay, etc.

Unit -3 Programmable Logic Controllers: hardware

Introduction, Basic parts of a PLC , Operation of a PLC , Basic symbols used in PLC realization , Difference between PLC and Hardwired systems , Difference between PLC and computer, Classification of PLCs

Unit -4 Programmable Logic Controllers: Programming language

Relay logic to ladder logic, Ladder commands, Examples of PLC ladder diagram realization, PLC timers, PLC counters and examples,

Unit – 5 Distributed control System:

History of DCS, DCS concepts, DCS hardware & software, DCS structure, Advantages and disadvantages of DCS, Representative DCS,

Unit – 6 SCADA system:

Introduction of SCADA system,, SCADA hardware & software, Application examples.

Reference Books:

1. Applied Instrumentation: William G. Andrews., Vol.-1
2. Process Control Instrumentation Technology by C. D. Johnson; Prentice Hall India.
3. Industrial instrumentation: Principles and Design by T.R.Padmanabhan
4. Process control (instrument engineers Hand book) by Liptak, Cinton Book Co.

- **Project   Work**

Semester-III
PAPER – INS – 535
Laboratory Session INS – 103

Group – A

11. **Study of Construction of DC Machine.**

12. **Study of Construction of Synchronous Machine.**

13. **Study of the Characteristics of Induction Motor.**

14. **Study of the characteristics of SCR.**

15. **Study of the characteristics of TRIAC.**

16. **Study of the characteristics of a power MOSFET.**

17. **Study of the characteristics of IGBT.**

18. **Study of the characteristics of D.C. Motor.**

19. **Study of speed control circuit of D.C. Motor.**

20. **Study of Induction Motor Starters.**

Group – B

11. **Study of the Phase controlled circuit.**

12. **Study of the converter circuits.**

13. **Study of the inverter circuits.**

14. **Study of AC Drives.**

15. **Study of DC Drives.**

16. **Study of Synchro transmitter and receiver system.**

17. **Microprocessor based controlled A.C. Motor.**

18. **Study of types of Earthing systems.**

19. **Study of Cable construction.**

20. **Study of speed control circuit of Induction Motor.**