INSTRUMENTATION

CODE IE 201

L	T	P
2	--	2

RATIONALE

To order to carry out the preventive maintenance of electronic gadgets, fault location, testing and calibration, knowledge and skill of electronic instruments is essential. The contents of this subject are to cover some of the aspects of electronic instruments.

CONTENTS

1. Multimeter :

1.1 Principle of measurement of

1.1.1 D.C. Voltage and current
1.1.2 A.C. Voltage and current
1.1.3 Resistance

1.2 AC and DC sensitivity
1.3 Calculation of shunt and multiplier for range extension
1.4 Loading effect
1.5 Specifications

2. Electronic Voltmeter :

2.1 Characteristics and specification of analog electronic voltmeter of different kinds
2.2 Circuits for DC voltmeter using BJTs and FETs (single device and balanced bridge type)
2.3. Ramp type Digital Volt Meter
2.4 Integrating type Digital Volt Meter

3. Cathode Ray Oscilloscope :

3.1 Block diagram of CRO
3.2 Construction of CRT
3.3 Deflection sensitivity and various controls
3.4 Detail of X-Y section and delay line
3.5 Horizontal sweep section
3.6 Synchronization of sweep and triggered sweep
3.7 Measurement of voltage, current frequency and phase angle using CRO
3.8 CRO probe
3.9 Construction and working of dual trace dual beam and analog storage type CRO's, High frequency probes.

4. Working Principle and Application of :

4.1 Q-meter
4.2 Transistor tester
4.3 Digital frequency counter
4.4 Analog IC tester
4.5 LCR Bridge
4.6 Output power meter (AF)
4.7 Function Generator

5. Signal Generation :

5.1 Sinewave generators,
5.2 Frequency synthesised signal generators
5.3 Sweep frequency generators
5.4 Special waveform generators.

6. Signal Analysis :

6.1 Measurement Technique,
6.2 Wave Analysers
  6.2.1 Frequency selective wave anslyser
  6.2.2 Hetrodyne wave analyser
6.3 Harmonic distortion analyser
6.4 Spectrum analyser.

7. Frequency :

7.1 Time & Interval measurement
  7.1.1 Resonance methods
  7.1.2 Wave meters
  7.1.3 Frequency counting
  7.1.4 Time Interval measurement
  7.1.5 System Time Counters

7.2 Frequency Counters - Gating error, Time base error, Trigger level error, High frequency measurements.

PRACTICALS

1. Measurement of DC voltage and current by multimeter
2. Measurement of AC voltage and current by multimeter
3. Measurement of resistance by multimeter
4. Complete study of multimeter and specification.
5. Study of electronic voltmeter
6. Study and use of CRO for voltage, frequency and phase angle measurement
7. Measurement of phase and frequency using lissagious figure by CRO
8. Testing of transistors using transistor tester
9. Testing of digital IC's using IC tester
10. Study of seven-segment display (LED and LCD)
11. Study of digital frequency meter
12. Study of digital voltmeter

REFERENCE BOOKS :

1. A Course in Electrical & Electronics Measurement & Instrumental — A.K. Sawhney
2. Modern Electronic Instrumentation & Measurement Techniques — Cooper
3. Electronic Instrumentation Fundamentals — Malvino
4. Electronic Measurement — Ternan Pettit

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ELECTRICAL ENGINEERING AND MEASUREMENTS

CODE IE 202

L	T	P
2	--	2/2

RATIONALE

This course aims to familiarise the students about the basic principles of electrical engineering, electrical machines and most generally used instrument for measurement of electrical quantity in industry. This curriculum helps them to operate the machines and different measuring instruments.

CONTENTS

6. Range Extension and Calibration :

6.1 Significance of range extension
6.2 Use of series and shunt multipliers
6.3 Instrument transformer for range extension
6.4 Working principle of potentionmeter
6.5 Calibration method of ammeter and voltmeter (D.C.) by potentiometer
6.6 Multirange ammeter and voltmeter
6.7 Simple problems
6.8 Vector impedance meter
6.9 Magger
6.10 Cable fault locator

PRACTICALS

1. Study of D.C. motor parts
2. Study the load characteristics of D.C. shunt and series motor
3. Study of induction motor
4. Study of synchronous motor
5. Study of stepper motor
6. Study of construction of moving coil, moving iron type instruments
7. Study of Maxwell's impedance, capacitive bridge.
8. Study of Hay's bridge
9. Study of Schering's bridge
10. Study of De-sauty's bridge and Wein bridge
11. Use of series multiplier for voltmeter range extension
12. Use of shunt multiplier for ammeter range extension
13. Calibration of voltmeter and ammeter (D.C.) using potentiomeor
14. Measurement of insulation resistance by megger
15. Study of induction type energy meter
16. Perform open circuit test on single phase transformer.
17. Perform Closed circuit test on single phase transformer.

REFERENCE BOOKS :

1.	A Course in Elect. Engg.	K.D. Sharma
2.	Electrical Technology	S.L. Uppal
3.	Electrical Technology	J.B. Gupta
4.	A Course in Electrical & Electronics Measurements & Measuring Instruments	A.K. Sawhrey
5.	Electrical Machine	I.J. Nagpal
6.	Electrical Technology	B.L. Thareja

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NETWORK ANALYSIS

CODE IE 203

L	T	P
2	1	--

RATIONALE

Analysis of any electronics circuit is essential for any electronics engineer. To analyse any circuit the knowledge of network elements and their behaviour, different types of networks and networks configuration is essential. Different network theorem and laws guide the proper way to analyse the networks. Laplace transformation helps an engineer to reduce the mathematical calculations.

CONTENTS

3.7 D.C. transients in RL, RC and RLC circuits

3.7.1 Determination of initial condition
3.7.2 Determination of final condition
3.7.3 Simple numerical problems

4. Network Theorems :

4.1 Statement, proof, application and numerical problems related to

4.1.1 Superposition theorem
4.1.2 Reciprocity theorem
4.1.3 Thevenin's theorem
4.1.4 Norton's theorem
4.1.5 Millman's theorem
4.1.6 Maximum power transfer theorem
4.1.7 Tellegen's theorem (Only statements)
4.1.8 Star Delta conversion

5. Two Port Networks :

5.1 Introduction
5.2 Open circuit impedance parameters
5.3 Short circuit admittance parameters
5.4 Hybrid (h) parameters
5.5 Transmission parameters
5.6 Inter-relationship between Z and Y parameters
5.7 Equivalent models of Z and Y parameters
5.8 Reciprocity and symmetry of two port networks
5.9 Equivalent T and π (Pie) section representation
5.10 Determination of Z and Y parameters for some special networks (T, π, lattice, bridge T)
5.11 Idea of image impedance, characteristics impedance for two port networks

6. Resonance :

6.1 Series resonance in uncoupled circuits
6.1.1 Definition, reactance curves, resonance condition, selectivity and bandwidth

6.2 Parallel resonance in uncoupled circuits
6.2.1 Circuit and phasor diagram
6.2.2 Derivation of resonance conditions
6.2.3 Selectivity and bandwidth

6.3 Q factor, Q factor on energy basis

REFERENCE BOOKS :

1. Network Analysis — Arumugan & Prem Kumar
2. Network Analysis — Dhar & Gupta
3. Network Analysis — Ven Valenburg
4. A Course in Circuit Analysis — Soni & Gupta
5. A Course in Circuit Analysis — Umesh & Sinha
6. Circuit Theory — Iyer
7. Electric Circuits — Josheep Edminster
8. Network Analysis — Suba Rao & Prasad
9. Circuit Analysis — Hayt

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CONCEPTS OF DIGITAL ELECTRONICS

CODE IE 204

L	T	P
2	--	2

RATIONALE

Basic digital electronics is the requirement of modern computer, microprocessor and digital communication systems. On account of reliability and accuracy digital electronic systems are replacing conventional analog systems. A diploma pass out having knowledge of digital system will be useful to the industries.

CONTENTS

1. Introduction :

1.1 Digital signal and its representation
1.2 Advantages of digital techniques

2. Number System :

2.1 Decimal, binary, octal and hexa-decimal number system
2.2 Conversion of a number from one system to another system
2.3 Binary addition, subtraction and multiplication
2.4 Representation of positive and negative numbers
2.5 1's complement and 2's complement
2.6 Subtraction using 2's complement
2.7 Parity bit
2.8 Binary codes (Gray, Excess -3, Hamming codes), ASCII code
2.9 Floating point number

3. Logic Gates :

3.1 Introduction
3.2 Symbol and truth table of NOT, AND, OR, NAND, NOR, EX-OR and EX-NOR gates
3.3 Universal gates
3.4 Positive, negative and tristate logic

4. Boolean Algebra :

4.1 Historical review - losgical statements, logical constants and variables, truth table
4.2 Boolean operators
4.3 Postulates of Boolean algebra
4.4 Laws of Boolean algebra
4.5 Duality theorem
4.6 De' Morgan's theorem
4.7 Simplification of Boolean expressions
4.8 Verification of Boolean expressions using truth table

5. Minimization Techniques (K-Mapping) :

5.1 Representation of Boolean expression - min. and max. term SOP, POS
5.2 Conversion of truth tables in POS and SOP form
5.3 Karnaugh map upto 4 variables - implication of logic function with and without don't care conditions
5.4 Realization of logic diagrams using NAND/NAND, NOR/NOR gate

6. Combinational Logic Design :

6.1 Binary half and full adder
6.2 Binary half and full subtractor
6.3 Binary serial, parallel and BCD adder
6.4 Parity bit generator and checker

6.5 Binary comparator
6.6 Multiplexer

6.6.1 4 to 1 multiplexer
6.6.2 16 to 1 multiplexer

6.7 Demultiplexer

6.7.1 1 to 4 Demultiplexer
6.7.2 1 to 16 Demultiplexer

6.8 Encoder

6.8.1 Decimal to BCD

6.9 Decoder

6.9.1 BCD to Decimal
6.9.2 BCD to seven segment

7. Sequential Systems :

7.1 Introduction
7.2 Symbol, logic circuit, truth table of R-S, J-K, M/S J-K,D,T flip-flops
7.3 Edge and level triggering
7.4 Shift registers

7.4.1 Left, right and bi-direction
7.4.2 Series and parallel
7.4.3 Universal shift register

7.5 Asynchronous and synchronous counters - up, down and up-down
7.6 Mod counters - Mod 5, Mod 9, decade counter
7.7 Ring counters, Johnson counter
7.8 Programmable counters
7.9 Use of shift register for simple binary multiplication and division.

8. Logic Families :

8.1 Classification of digital ICs.
8.2 Characteristics of digital ICs.
8.3 RTL/RCTL
8.4 DTL
8.5 TTL logic - Operation of TTL NAND gate, open collector and totem - pole output, characteristics of TTL, TTL subfamilies
8.6 Concept of ECL and I^2 L.
8.7 PMOS, NMOS and CMOS (NAND, NOR, NOT) Circuits.
8.8 Comparison of logic families
8.9 Interfacing TTL with CMOS family

PRACTICALS

1. Verify the truth tables of NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR gates
2. Design a NOT, AND, OR, EX-OR, EX-NOR gates using universal gates
3. Design a binary half and full adder
4. Design a binary half and full substractor
5. Study of BCD to 7 segment decoder
6. Verify the truth table of RS, D, J-K, M/S J-K,D,T flip-flops.

7. Study of asynchronous binary ripple up, down and up-down and different mod counters
8. Study of synchronous counters
9. Study of decade counter
11. Study of programmable counter
12. Study of a shift register using flip flops
13. Study of ring counter using flip flops

REFERENCE BOOKS :

1.	Digital Principles & Applications	Malvino Leach.
2.	Integrated Electronics	Millman & Halkias
3.	Digital Electronics	T.C. Bartee
4.	Digital Electronics Practice Using IC's	R.P. Jain.
5.	Modern Digital Electronics	R.P. Jain
6.	Digital Electronics	L. Solanki
7.	Digital Intregrated Circuit	K.R. Botker
8.	Digital Design	Flloyd
9.	Digital Logic Design	Morris Mano.

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CONCEPTS OF ELECTRONIC DEVICES AND CIRCUITS

CODE IE 205

L	T	P
2	--	2

RATIONALE

Today is the day of electronics. This subject covers the basic concept of electronics for engineers, this subject is foundation of electronics which helps the student to study the other subject.

CONTENTS

1. Vacuum Tubes :

1.1 Types of emissions.
1.2 Brief idea of construction, characteristics, working and applications of

1.2.1 Diode Valve.
1.2.2 Triode Valve.

2. Semiconductor and PN Junction :

2.1. Metal, non metals and semiconductors and their Energy Band Diagram.
2.2 Intrinsic and Extrinsic Semiconductors.
2.3 Effect of temperature on extrinsic semiconductor
2.4 Energy band diagram of extrinsic semiconductor
2.5 Fermi Level and fermi dirac distribution
2.6 Drift and diffusion current
2.7 Hall Effect
2.8 P-N Junction Diode
2.8.1 Space charge region, Barrier potential and effect of temperature
2.8.2 Energy band diagram
2.8.3 Biasing of diode.
2.8.4 V-I characteristics
2.8.5 Static and dynamic resistance
2.8.6 Transition and diffusion capacitance
2.8.7 Zenner and Avalanche breakdown

2.9 Working, characteristics and application of

2.9.1 Tunnel diode
2.9.2 Zener diode
2.9.3 Varactor diode
2.9.4 Photo diode
2.9.5 Light emitting diode (LED)

2.10 Photo conductors
2.11 Cds photo conductive cells and photo voltaic cell.

3. Bipolar Junction Transistor (BJT) :

3.1 Constructional details of PNP and NPN transistors
3.2 Working of a transistor

3.2.1 Charge transport phenomenon
3.2.2 Transistor amplifying action
3.2.3 Relation between different currents in a transistor
3.2.4 Simple problems

3.3 Configuration of transistor (CB, CE and CC)
3.4 Behavior of BJT in Active, Cut off and Saturation regions

3.4.1 Transistor as a switch
3.4.2 Transistor as an amplifier

4. Transistor Biasing and Bias Stability :

4.1 D.C. and A.C. Load line.
4.2 Operating point and its stability
4.3 Factors affecting bias stability
4.4 Stability factors
4.5 Bias stabilization
4.6 Calculation of operating point and stability factor for

4.6.1 Fixed Bias Circuit.
4.6.2 Collector to base biasing.
4.6.3 Voltage Divider biasing (Self bias)

4.7 Bias Compensation techniques using

4.7.1 Diode.
4.7.2 Thermistor and Sensistor.

4.8 Thermal stability and Thermal runaway

5. Small Signal Transistor Amplifier :

5.1 CB, CE and CC amplifier and their low frequency small signal equivalent circuit using hybrid parameters.
5.2 Calculation of voltage gain, current gain, input impedance, output impedance and power gain for resistive loads. (Av, Ai, Zi, Zo, Avs, Ais, and Ap)
5.3 Analysis of emitter follower circuit
5.4 Approximate analysis of CE amplifier with and without R_E , Emitter follower circuits
5.5. Classification of amplifiers

6. Field Effect Transistor :

6.1 Construction, operation and characteristics of JFET , E and D MOSFET

6.2 Biasing of FET
6.3 Small signal model of JFET
6.4 Terminology used with JFET
6.5 Precaution for handling of MOSFETs

7. Rectifiers and Power Supplies :

7.1 Working of rectifiers

7.1.1 Half wave rectifier
7.1.2 Centre tape full wave rectifier
7.1.3 Bridge rectifier

7.2 Analysis of rectifiers (for all type)

7.2.1 Calculations for average and RMS values
7.2.2 PIV of diodes
7.2.3 Ripple factor
7.2.4 Regulation and efficiency

7.3 Calculation of ripplefactor and working of following filters:

7.3.1 Capacitance filter
7.3.2 Inductance filter
7.3.3 L-C and π (Pie) filters

7.4 Voltage Multipliers
7.5 Regulated power supply using zener diode

7.5.1 Simple problems on zener regulator.

PRACTICALS

1. To plot the V-I characteristics of P-N diode and LED.
2. To plot the V-I characteristics of zener diode and study of zener diode regulator circuit
3. To plot the V-I characteristics of PNP transistor in CB, CE and CC configuration
4. To plot the V-I characteristics of NPN transistor in CB, CE and CC configuration and calculate h-parameter for CE configuration.
5. Study of the different biasing circuits and observe the effect of component variation on operating point
6. Study of half wave and full wave rectifiers.
7. Study of bridge rectifier.
8. To study the filter circuits and measure the ripple factor.
9. To plot the V-I characteristics of JFET
10. To plot the V-I characteristics of MOSFET.
11. To study the voltage multipliers.
12. To Study Emitter follower circuits and measure its input and output impedances
13. To study the behavior of Cds photo conductive, photo voltaic cell and photo conductors

REFERENCE BOOKS :

1. Electronic Devices & Circuits — Millman & Halkias
2. Electronic Devices & Circuits — G.K. Mittal
3. Electronic Devices & Circuits — A.Mottershed
4. Functional Electronics — K.V. Ramanan
5. Electronic Devices & Circuits — Mathur, Kulshrestha & Chadda
6. Electronic Devices & Circuits — Sanjeev Gupta

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INDUSTRIAL INSTRUMENTATION

CODE IE 206

L	T	P
3	--	2/2

RATIONALE

Instrumentation is the heart of the process industry, It plays a very important role in the production. In order to run the industry smoothly and efficiently it is very much needed. Fundamentals of instrumentation gives an introduction to the subject.

CONTENTS

1. Basic of Instrumentation :

1.1 Names of important process parameters, their units, necessity of measuring these parameters
1.2 Primary & secondary standards
1.3 Name of the sensors used for above parameters and their ranges
1.4 Direct & indirect measurement
1.5 Static & dynamic characteristics
1.6 Actuating, controlling & damping methods
1.7 Concept of under, over and critical, damping
1.8 Source of errors
1.9 Classification of errors
1.10 Their remedies
1.11 Simple numerical problems

2. Flow :

2.1 Introduction
2.2 Differential pressure flow meter
2.3 Orifice plates
2.4 Venturi tubes
2.5 Flow nozzles
2.6 Dall tubes
2.7 Pitot tubes
2.8 Annubar tubes
2.9 Rotameter
2.10 Electromagnetic and ultrasonic flow meters
2.11 Vortex flow meters
2.12 Mass flow type meters
2.13 Shunt flow meters

3. Level :

3.1 Introduction
3.2 Float type
3.3 Displacement type
3.4 Hydrostatic type
3.5 Diaphragm type
3.6 Differential pressure method
3.7 Electrical conductivity method
3.8 Capacitance level
3.9 Ultrasonic and nucleonic gauges
3.10 Capacitance probes
3.11 Solid level detectors

4. Density :

4.1 Introduction
4.2 Hydrometers
4.3 Density of gases
4.4 Metering orifice
4.5 Gas impulse wheel methods
4.6 Gas specific gravity measuring system

5. Moisture / Humidity :

5.1 Moisture content of materials
5.2 Methods of measurement of moisture
5.3 Humidity
5.4 Methods of measurement of humidity

6. Viscosity :

6.1 Introduction
6.2 Co-efficient of viscosity and temperature
6.3 Ostwald method of determination of viscosity
6.4 Free fall of piston under gravity
6.5 Two float viscometer
6.6 Torque method
6.7 Ultrasonic shear waves method
6.8 Temperature compensation

7. Pressure :

7.1 Introduction
7.2 Conventional pressure transducers
7.3 Mechanical pressure transducers

- 7.3.1 Manometer method
- 7.3.2 C-type Bourdon tube
- 7.3.3 Diaphragm
- 7.3.4 Bellows

7.4 Measurement of vacuum
7.5 Force balance pressure gauges
7.6 Electrical pressure transducers

- 7.6.1 Strain gauge pressure transducer
- 7.6.2 Potentiometric pressure transducer
- 7.6.3 Capacitive pressure transducer
- 7.6.4 Piezo electric pressure transducers

8. Temperature :

8.1 Introduction
8.2 Temperature scales
8.3 Temperature measuring theory
8.4 Methods of measuring temperature, filled systems
8.5 Resistance thermometer
8.6 Thermocouples
8.7 Bimetallic thermometer
8.8 Thermistors
8.9 Radiation pyrometer
8.10 Optical pyrometer
8.11 Thermographic color change, Acoustical, Quartz crystal thermometers

9. Vibration :

9.1 Introduction
9.2 Methods of vibration measurement
9.3 Vibration pick-ups
9.4 Vibrometers
9.5 Measuring, monitoring and balancing

10. Speed Measurements :

10.1 Introduction
10.2 Mechanical tachometers
10.3 Electrical tachometers
10.4 Contact less tachometers
10.5 Frequency type tachometers
10.6 Stroboscopic tachometers

11. Miscellaneous Measurement :

11.1 Force and Torque
11.2 Acceleration and Velocity
11.3 Weight

PRATICALS

1. Measurement of flow by rotameter
2. Study and testing of house water meter
3. Measurement of flow by orifice method
4. Measurement of flow by differential pressure flow meter
5. Measurement of flow by magnetic flow meter
6. Study of vibration pick-ups
7. To determine relative humidity by wet and dry bulb hygrometer
8. Measurement of viscosity by red wood viscometer
9. Measurement of density by Hydrometer
10. Measuring of speed of a motor by hand tachometer
11. Measurement of speed of a motor fan by electronic stroboscope method
12. Measurement of temperature by thermistor
13. Measurement of temperature by filled system
14. Measurement of pressure by Bourden tube pressure gauge
15. Measurement of pressure by manometer
16. Study of various pressure elements

REFERENCE BOOKS :

1. Mechanical and Industrial Measurements R.K. Jain
2. Industrial Instrumentation and Control S.K. Singh

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TRANSDUCERS & TELEMETRY

CODE IE 207

L	T	P
2	--	2

RATIONALE

The students should know the type of signal received from the primary instrument and its treatment so that it can be used for measurement and control purposes. Here he will study different types and use of signal generating transducers.

In instrumentation system, the various components comprising the system are usually located at a distance from control room. The make connection between components the subject is included.

CONTENTS

8.1.1.3 Non bleed type
8.1.1.4 Bleed types feed back
8.1.1.5 Limitations

8.1.2 Electric system

8.1.2.1 Current system
8.1.2.2 Voltage system
8.1.2.3 Impulse system
8.1.2.4 Position system or ratio system
8.1.2.5 Frequency system

8.2 Radio frequency telemetering

8.2.1 Amplitude modulation
8.2.2 Frequency modulation
8.2.3 Phase modulation
8.2.4 Pulse modulation
8.2.5 Pulse amplitude modulation
8.2.6 Pulse code modulation

9. Transmitters :

9.1 Pneumatic transmitter

9.1.1 PDPT bellow type
9.1.2 PDPT diaphragm type

9.2 Electric transmitters

9.2.1 Wheatstone bridge
9.2.2 Inductance bridge
9.2.3 Impedance bridge
9.2.4 Differential transformer
9.2.5 Synchro

9.3 Electronic force balance DPT
9.4 Hydraulic transmitter

10. Transmission Channels and Media :

10.1 Wire line channels
10.2 Radio channels
10.3 Microwave channels
10.4 Power line carrier channels
10.5 Multiplexing channels

10.5.1 Frequency division
10.5.2 Time division

11. Process Lags :

11.1 Measurement lags

11.1.1 Capacity lag
11.1.2 Transfer lag
11.1.3 Distance velocity lags
11.1.4 Effects of measurement lags

11.2 Single capacity process
11.3 Multi capacity process
11.4 Examples

PRACTICALS

1. To draw input output characteristics of linear variable differential transformer.
2. To draw the resistance temperature characteristics of RTD
3. To draw the resistance temperature characteristics of thermistor
4. To draw the temperature characteristics of thermocouple
5. Measurement of thickness of a object using capacitive transducer.
6. Measurement of stress / pressure / weight by strain gauge.
7. To study the synchro transmitter and receiver
8. Torque transmission by synchro transmitter - receiver
9. Realization of various process lags
10. Measurement of pressure using pneumatic transmitter
11. Measurement of differential pressure using PDPT
12. Realization of electric transmitter
13. Realization of electronic force balance DPT
14. Study of hydraulic transmitter
15. Study of different types of pilot relays

REFERENCE BOOKS :

1. Mechanical & Industrial Measurements — R.K. Jain
2. Modern Control Engineering — Ogata
3. Fundamentals of Instrumentation — A.E. Fribance
4. Electrical Measurements and Instrumentation — A.K. Sawhney
5. Industrial Instrumentation and Control — S.K. Singh
6. अग्रित यंत्रीकरण एवं नियंत्रण — एम. एफ. कुरेशी
7. यंत्रीकरण एवं नियंत्रण — डॉ. एच.एम. राय

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CONTROL SYSTEM COMPONENTS

CODE IE 208

L	T	P
2	--	2/2

RATIONALE

Measurement of voltage, angular displacement, angular velocity and speed control of motors are a few requirements of the present day industry this subject gives a detailed study of the instruments sued for these measurements.

The knowledge about this subject as the function of final control elements is to carryout faithfully the commands given to it by the controller. Sluggish response by the elements to the system can be harmful. The final control elements are major link in the control loop.

CONTENTS

1. Error Sensing Devices :

1.1 Potentiometer as an error detector
1.2 Synchro as an error detector

2. Servo Amplifiers :

2.1 Rotating amplifier

2.1.1 Principle of operation
2.1.2 Construction and load characteristics of amplidyne
2.1.3 Transfer function of an amplidyne

2.1.4 Applications of amplidyne

2.1.4.1 Paper mill control using amplidyne and others

2.2 Magnetic amplifier

2.2.1 Basic principle of operation
2.2.2 Series and parallel connection
2.2.3 Load line analysis
2.2.4 Amplifier with feed back

2.3 Electronic Amplifiers

2.3.1 Introduction
2.3.2 D.C. Amplifier
2.3.3 A.C. Amplifier

3. Servo Motors :

3.1 D.C. Servomotor

3.1.1 Construction and working of D.C. servomotor
3.1.2 Circuit diagram and working of field controlled D.C. servomotor
3.1.3 Circuit diagram and transfer function of armature controlled D.C. motor
3.1.4 Torque speed characteristics of D.C. servomotor
3.1.5 Applications of D.C. servo motors

3.2 A.C. Servomotor
3.2.1 Schematic diagram and working of two-phase servo motor
3.2.2 Types of rotor
3.2.3 Torque speed characteristics of A.C. servo motor
3.2.4 Applications of A.C. servo motor

3.3 Construction and working of shaded pole induction motor

4. Stepper Motor :

4.1 Construction
4.2 Working principle
4.3 Speed and static torque angle characteristics of stepper motor
4.4 Application of stepper motor

5. Techogenerators :

5.1 Principle and working of A.C. and D.C. techogenerators
5.2 Position and speed control with feed back through techogenerator

6. Final Control Elements :

6.1 Air operated valve

6.1.1 Construction
6.1.2 Characteristics
6.1.3 Sizing and selection
6.1.4 Materials and services
6.1.5 Different types of plugs and their applications

6.2 Actuators
6.3 Valve positioners
6.4 Power cylinders

6.5 Special control valves

6.5.1 Small flow valves
6.5.2 Saunders patent valve
6.5.3 Butterfly valves
6.5.4 Solenoid valve
6.5.5 Motorized valve
6.5.6 Dampers

6.6 Installation of above valve

7. Contactor Control Elements and Circuits :

7.1 Basic construction of contactor
7.2 Push buttons
7.3 Thermal protection relay
7.4 Time delay relay
7.5 Inter locking and sequencing circuits
7.6 Applications
7.7 Introduction to ladder diagram

8. Switches :

8.1 Pressure switches
8.2 Temperature switches
8.3 Flow switches
8.4 Level switches
8.5 Limit switches

PRACTICALS

1. Realization of potentiometer as an error detector
2. Realization of a synchro pair as an error detector
3. To draw the torque speed characterization of a D.C. servo motor
4. Measurement of speed with techogenerator
5. Study of amplidyne
6. Realization of magnetic amplifier
7. Speed control of stepper motor.
8. Study of butterfly valves
9. Control of flow by pneumatic control valve
10. Control of level by solenoid valve
11. To draw the characteristic of pneumatic control valve
12. To calibrate a control valve
13. To draw the characteristic of pneumatic valve positioner
14. To make automatic Y-Δ starter circuit for induction motor
15. To realize interlocking connection for motor
16. To make sequencing connection for motor
17. To make a control circuit using various switches

REFERENCE BOOKS :

1. Control System Component — Gibson & Teuter TMH
2. Control Engineering — Dr. A.K. Tandan, Dr. A. Subha Rao, Dr. S.K. Kulkarni, Dr. Parag S. Desai
3. Control Component — B. Chatterjee
4. Handbook of Instrumentation and control — H. P. Kallen
5. Process Instruments and controls Handbook — D.M. Considine
6. Electrical Design Estimating and Costing — Raina & Bhattacharya

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ANALYTICAL & ENVIRONMENTAL INSTRUMENTATION

CODE IE 209

L	T	P
2	--	2/2

RATIONALE

Today the whole world is facing the problem of pollution. The pollution may be of air, water etc. Whenever installation of a new industry takes place problem of waste and gasses come in picture. Our government is also sincere towards the problem of pollution. It therefore becomes essential to study different methods of analysing the gas and water. Students will measure and check the different harmful gasses in air and water. After study of this subject a student will be in a position to analysis and control the harmful elements. To impart latest development in opto devices in the field of instrumentation technology this subject is included in the syllabus.

CONTENTS

1. Spectroscopic Analysis :

- 1.1 Absorption spectroscopy
- 1.2 Emission spectroscopy
- 1.3 Mass spectroscopy

2. Gas Analysis :

- 2.1 Infrared gas analyser
- 2.2 Paramagnetic oxygen analysers
  - 2.2.1 Magnetic force type
  - 2.2.2 Magnetic wind type
- 2.3 Thermal conductivity analysers

3. Chromatography :

- 3.1 Introduction
- 3.2 Analysis section
- 3.3 Control section
- 3.4 On line liquid chromatography

4. Liquid Analysis :

- 4.1 Electrical conductivity
- 4.2 Ph electrode potentials
- 4.3 Electrochemical analyser

5. Environmental Pollution Instruments :

- 5.1 Types and concentration of various gas pollutant in atmosphere
- 5.2 Lionization smoke detectors
  - 5.2.1 Principle
  - 5.2.2 Application
  - 5.2.3 Special features
- 5.3 Smoke meters
- 5.4 Dust measurement
- 5.5 Visible emission monitoring systems

6. Optical Analysis Instruments :

- 6.1 Optical Pyrometer
- 6.2 Infra-red thermometer

6.3 Polarimeter
6.4 Light Intensity meter
6.5 Spectrophotometer
6.6 Spectrum Analyser
6.7 X-Ray Fluoroscopic Instruments
6.8 Periscope
6.9 Optical Filters
6.10 Beam splitters

7. Water Pollution and Its Monitoring.
8. Noise Pollution and Its Monitoring.

PRACTICALS

1. Measurement of pH for given liquid
2. To analyse gas sample by thermal conductivity method.
3. To measure Co_2 in a given sample by Co_2 analyser
4. To measure conductivity of a given solution by conductivity meter.
5. To measure total dissolved O_2 in water
6. To study spectra photometer
7. Analysis of gas-by-gas chromatograph
8. Demonstration of infrared Analyser
9. Demonstration of Mass spectrograph
10. Measurement of light intensity by lux meter.
11. Measurement of radiation by infrared meter.
12. Study of optical filter.

REFERENCE BOOKS :

1. Mechanical & Industrial Measurements — R.K. Jain
2. Principles of Industrial Instrumentation — D. Patranabis
3. Handbook of Analytical Instrument — R.S. Khandpur
4. Optical Production Theory — Horn
5. Opto Electronics an Introduction — J. Wilson – J.F.B. Hawkes

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'C' PROGRAMMING

CODE IE 210 L T P
same in all branches except AR/CC/CE/CS/ EE /IT 2 -- 2

RATIONALE

'C' is computer programming language and also structured programming language. In 'C' programming language we consider various syntax used in programming. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in the engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas. This course is specially designed for engineering students of all diploma streams.

CONTENTS

1. Introduction :

1.1 Scope of 'C' Language
1.2 Distinction and similarities with other HLLs
1.3 Special features and Application areas

2. Elements of 'C' :

2.1 Character set
2.2 Key words

2.3 Data types
2.4 Constants and Variables
2.5 Operators: unary, binary, ternary
2.6 Operator precedence

3. Console Input-Output :

3.1 Types of I-O
3.2 Console I-O
3.3 Unformatted console I-O: getchar(),putchar(), gets(), puts(), getch(),getche()
3.4 Formatted I-O: scanf(), printf()

4. Control Flow :

4.1 Statements and blocks
4.2 if
4.3 switch
4.4 Loops: for, while, do-while
4.5 goto and labels
4.6 break, continue, exit
4.7 Nesting control statements

5. Arrays :

5.1 Basic concepts
5.2 Memory representation
5.3 One dimensional array
5.4 Two Dimensional array

6. Functions:

6.1 Basic concepts
6.2 Declaration and prototypes
6.3 Calling
6.4 Arguments
6.5 Scope rules
6.6 Recursion
6.7 Storage classes types
6.8 Library of functions: math, string, system

7. Pointers :

7.1 Basic concepts
7.2 &, * operator
7.3 Pointer expression: assignment, arithmetic, comparison
7.4 Dynamic memory allocation
7.5 Pointer v/s Arrays

8. Structure and Enumerated Data Types :

8.1 Basic concepts
8.2 Declaration and memory map
8.3 Elements of structures
8.4 Enumerated data types: typedef, enum
8.5 Union

PRACTICALS

1. Problems based on arithmetic expression, fixed mode arithmetic.
2. Problems based on conditional statements and control structures.
3. Problems based on arrays (1-D, 2-D), functions and pointers.
4. Problems based on engineering applications.

REFERENCE BOOKS:

1. 'C' Programming — Stephen Kochan
2. Programming with 'C' — Schaum's Series
3. 'C' Programming — V.Balguru Swami
4. 'C' Programming — Kernighan & Ritchie
5. Let us 'C' — Yashwant Kanetkar

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