

Curriculum and Scheme of Examinations
Diploma in Instrumentation and Control
Engineering

III Term

S.No	Code No	Course Name	Hours/ Week	Credit	Scheme of Examination Allocation of Marks			Duration of Exam (Hrs)
					Internal	External	Total	
1	C201	Electronic devices & circuits	7	7	25	75	100	3
2	C202	Basics of Instrumentation	7	7	25	75	100	3
3	C203	Circuits & machines	6	6	25	75	100	3
4	C204	Electronic Devices & circuits lab	6	3	25	75	100	3
5	C205	Basics of instrumentation lab	6	3	25	75	100	3
6	C206	Circuits & machines lab	3	1.5	25	75	100	3
		Total	35	27.5	150	450	600	18

C201 - ELECTRONIC DEVICES & CIRCUITS

III Term (Core)

7 Hours / Week

Total Hours : 84

Major Divisions

- Unit I Components, Diodes, Transistors
- Unit II Special Devices
- Unit III Opto Electronic & Microwave Devices
- Unit IV Digital Devices & Circuits
- Unit V Electronic Circuits

Unit I - COMPONENTS, DIODES, TRANSISTORS

(17 hrs)

a) Components

Passive and active components – Resistors – fixed and variable – carbon, metal film, metal oxide, wire wound(working principle only, no constructional details) – colour coding – specification with respect to size, power rating, accuracy and temperature – uses

b) Diodes

Energy band diagram – intrinsic and extrinsic semiconductor – PN junction under forward and reverse bias – Characteristics of silicon, germanium, gallium – arsenide diodes – cut in and break down voltage – applications

c) Transistors

Bipolar junction transistors – PNP and NPN transistors – Transistor action – Three

configurations(Qualitative treatment only) – cut off – cut in, conduction and saturation – reverse saturation current – current gain and voltage gain – typical values
Unit II - SPECIAL DEVICES (17 Hrs)

JFET – operation and characteristics – MOSFET types – IGFET – operation and characteristics in depletion and enhancement modes – pinch off voltage, parameters r_d , g_m and μ (qualitative only) – VMOS – Applications Of FET UJT – Operation and characteristics – applications (qualitative only) – Thyristors – principle of operation – characteristics – ratings – turn on and turn off methods – applications of SCR – DIAC – and TRIAC – characteristics, ratings and applications – Zener diode – working – characteristics – break down – Zener regulator – uses.

Unit III - OPTO ELECTRONIC & MICROWAVE DEVICES (17 Hrs)

Principle of operation, characteristics, symbol and uses of photo diode, photo transistor, solar cell, LDR, LED, LCD, photo conductive cells – IR emitters (concept only) – laser diodes – working and characteristics - applications.

Operation – characteristics – symbol and uses of tunnel diode – Varactor diode – Gunn diode – PIN diode – Schottky diode and step recovery diode.

Unit IV - DIGITAL DEVICES AND CIRCUITS (17 Hrs)

Boolean algebra – basic laws – DeMorgan's laws – logic gates – OR, AND, NOT, NAND, NOR, EXOR, EXNOR and INHIBIT – combinational logic using NAND, NOR gates.

IC characteristics of TTL, ECL, I^2L , CMOS technologies – precautions in handling CMOS IC – flip flops – RS, D, T and JK(qualitative treatment only)
Counter circuit, state and timing diagram

Asynchronous – ripple counter – 4bit binary up/down counter – synchronous counters – encoders – decoders – multiplexer – and demultiplexer – tristate and bidirectional buffer.

Unit V - ELECTRONIC CIRCUITS (16 Hrs)

Amplifiers – classification of amplifiers – CE, CB, CC transistor amplifier – comparison – RC coupled – cascade – Darlington amplifiers(brief explanation – power amplifiers – class A, AB, B and C types (qualitative treatment only) – DC amplifier (transistor version) – concept of feedback – oscillators – effect of feedback on gain – Barkhausen criterion – classification of oscillators – crystal oscillator(transistor version).

Wave shaping circuits – Diode clipper and clamper – Schmitt trigger – saw tooth generator

Reference Books:

1. Allen Mottershed, "Electronic Devices and Circuits", Prentice hall of india.
2. P.Bhattachariya, "Opto Electronic Devices".
3. Samuel Liao, "Micro wave Devices and Circuits", Prentice hall of india, Edn 3.
4. Malvino, "Electronic Principles", Tata Mc Graw Hill, Edn 5.

C202 BASICS OF INSTRUMENTATION

III Term (Core)

7 Hours / Week

Total Hours : 84

Major Divisions

- Unit I Basic Building Blocks Of Instrumentation
- Unit II Performance Characteristics Of Instruments
- Unit III Principles And Features Of Transducers
- Unit IV Signal Conditioners
- Unit V Data Transmission And Recording Devices

Unit I - BASIC BUILDING BLOCKS OF INSTRUMENTATION (17 Hrs)

Instrumentation system – definitions – block diagram and functional elements of measurement system – typical examples of instrumentation system – error analysis – types of errors – gross errors, systematic errors and random errors – statistical treatment of data – histogram, arithmetic mean, standard deviation and variance – simple problems

Unit II - PERFORMANCE CHARACTERISTICS OF INSTRUMENTS (17 Hrs)

Static characteristics – accuracy, precision, sensitivity, linearity, resolution, hysteresis, input/output impedances, threshold and dead time – dynamic characteristics – speed of response, fidelity, lag and dynamic error – range span – standard input signals – response of first and second order instruments for a step input – concept of time constant, natural frequency and damping factor.

Unit III - PRINCIPLES AND FEATURES OF TRANSDUCERS (17 Hrs)

Definition – classifications – pressure sensitive devices – bourdon tubes, diaphragms and bellows – electrical transducers – advantages over mechanical transducers – primary and secondary transducers, active and passive transducers, analog and digital transducers – resistive transducers – potentiometers, strain gauges, resistive thermometer and thermistor – working principle, construction and applications of the above transducers – LVDT – thermocouples – capacitive transducers – piezo electric transducers – electrical equivalent circuit – construction and applications of these

Unit IV - SIGNAL CONDITIONERS

(17 Hrs)

Block diagram of DC signal conditioning system & AC signal conditioning system – instrumentation amplifier – AC amplifier and DC amplifier (frequency response only) – operational amplifier – definitions – ideal characteristics – adder, multiplier, integrator, and differentiator – differential amplifier – advantages of differential amplifier – use of OP Amp with capacitive and piezo electric transducers – filters – low pass, high pass, band pass and band rejection filters – wheatstone bridge circuit – null type and deflection type – AC bridges – general form – Maxwell's bridge – Deauty's bridge – voltage to frequency converter – counter ramp ADC – 8bit DAC using R-2R ladder network

Unit V - DATA TRANSMISSION AND RECORDING DEVICES

(16 Hrs)

Data transmission system – block diagram – cable transmission – analog signal transmission & digital data transmission – advantages and disadvantages of digital transmission system over analog transmission – time division multiplexing

Recorders – recording requirements – graphic recorders – strip chart recorder – marking mechanism – XY recorder – magnetic tape recorder – single and multipoint recorder – F.M recording – pulse duration modulation recording – principle, advantages & disadvantages of above – digital tape recorder

Reference Books :

1. A.K. Sawhney, "A course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co.
2. H.S. Kalsi, "Electronic Instrumentation", 6th Print (1999) Tata Mc Graw Hill Publishing Ltd., New Delhi.
3. Ernest O. Doebelin, "Measurement Systems (Applications and Design)", 4th Edn Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
4. S.K. Singh, "Industrial Instrumentation and Control", Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
5. A.K. Sawhney, "A course in Mechanical Measurements & Instrumentation", Dhanpat Rai & Co.

C203 CIRCUITS AND MACHINES

III Term (Core)

6 Hours / Week

Total Hours : 72

Major Divisions:

- Unit I DC & AC Circuits
- Unit II Resonance And Networks
- Unit III Digital Circuits And Power Supplies
- Unit IV DC Machines And Batteries
- Unit V AC Machines

UNIT I DC AND AC CIRCUITS (14 Hrs)

DC circuits – concept of electrical quantities – V, I, R – ohm's law and kirchoff's law – series and parallel circuits – combination – electrical power and energy (simple problems only)

Concepts of magnetic quantities – faradays and lenzs law (definition and concept only) – induced emf – self and mutuall induced emf – energy stored in inductor – capacitance – series and parallel – dielectric permittivity – energy stored in a capacitor

AC circuits – sinusoidal and non sinusoidal waveforms – period, frequency, amplitudes, phase, peak value, peak value, average value, RMS value,form factor, crest factor (definition, equation and concepts only – no derivation)

Concept of reactance and impedance – susceptance, conductance and admittance (no derivation) – power in AC circuits and power factor – 3 phase supply – line voltage, line current, phase voltage, phase current(concept and equation only, no derivation)

UNIT II RESONANCE AND NETWORKS (14 Hrs)

Concepts of transients in RL, RC and RLC combination (no derivation required) – electri- cal resonance – series and parallel condition for resonance – resonance curve – Q factor and bandwidth – applications of resonance.

Super position, thevinin's, norton's and maximum power transfer theorems (statements and equations only – no derivation and proof required).Simple problems with direct applica- tions only.

UNIT III - DIGITAL CIRCUITS AND POWER SUPPLIES (14 Hrs)

Binary algebra – 1's complement and 2's complement – addition –signed binary numbers – simple problems.

Half adder – full adder – parity generator and checkers – code converters

LED and drive circuits – 7 segment display – latched display and multiplexed display circuits – rectifier – half wave, full wave and bridge rectifier – metal rectifier (no derivations) – filters – types – regulators – series and parallel – 78xx and 79xx IC regulators – SMPS and UPS – working and applications.

UNIT IV - DC MACHINES AND BATTERIES

(15 Hrs)

DC motor – principle and working – types – back emf – torque equation (no derivation) – starters – 3 point and 4 point starters – speed control of DC motors – applications of DC motors

Batteries – types of batteries – storage batteries – construction and working of lead acid cell – charging and discharging of batteries – maintenance of batteries – use of standard cells

UNIT V AC MACHINES

(15 Hrs)

AC motors – synchronous and induction motors – working principle – types – applications – stepper motor – types – working - applications – servo motor - types – working – applications – tachometer generator – working – applications – transformer – working principle - applications

Reference Books :

1. B.L. Theraja, “Electrical Technology”, Schand and Company, Vol II.
2. V.K Metha, “Electronic Principles”.
3. Joseph Edminister, Schaum Series, “Electric Circuits”, TMH.

C205 BASICS OF INSTRUMENTATION LAB

III Term (Core)

6 Hours / Week

Total Hours : 72

List of Experiments :

1. Linearity of potentiometer
2. Calibration of instruments 1.voltmeter 2.ammeter using standard meters
3. LVDT characteristics.
4. Thermistor characteristics (PTC & NTC)
5. Instrumentation amplifier characteristics.
6. Performance of differential amplifier.
7. Measurement of resistance using wheat stone bridge.
8. Construction and testing the performance of integrator and differentiator using OP AMP
9. Conversion of analog to digital signal using OP AMP (A / D)
10. Conversion of digital to analog signal using OP AMP (D / A)
11. Measurement of inductance using Maxwell's bridge.
12. Measurement of capacitance using Desauty's bridge.
13. Strain gauge characteristics (load cell)

C206 CIRCUITS AND MACHINES LAB

III Term (Core)

3 Hours / Week

Total Hours : 36

List of Experiments :

1. Verification of ohm's law and kirchoff's law.
2. Plotting resonance curve for series resonant circuit and obtain resonant frequency
3. Determination of reactance and impedance of a given passive element for different frequencies
4. Construction and testing of bridge rectifier with filter
5. Construction and working of IC voltage regulator
6. Speed control characteristics of a DC shunt motor.
7. Construct and test the performance of half adder and full adder circuits.
8. Study of stepper motor
9. Study of servo motor.
10. Characteristics of AC / DC servo motor
11. Verification of performance of half wave and full wave rectifier with filter.
12. Study on performance of 3 point starters.
13. Study on charging and discharging of storage batteries.
14. Construct and test the performance of 7 segment display.