

DIPLOMA SYLLABUS

CONTROL AND INSTRUMENTATION



DEPARTMENT OF INSTRUMENTATION ENGINEERING

केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार
CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

(A Centrally Funded Institute under Ministry of HRD, Govt. of India)
BODOLAND TERRITORIAL AREAS DISTRICTS :: KOKRAJHAR :: ASSAM :: 783370

CENTRAL INSTITUTE OF TECHNOLOGY
 (Centrally Funded Institute under Ministry of HRD, Govt. of India)
 KOKRAJHAR :: 783 370 :: (BTC) ASSAM

Module: Diploma Batch: CAI Semester: 3rd

Course Code	Name of the Course	L-T-P	Total Marks
Co-301	Computer Application	2 – 0 – 6	150
Hu-302	Engineering Economics & Accountancy	3 – 1 – 0	100
Sc-303	Mathematics – III	3 – 2 – 0	100
CAI-301	Principles of Electrical and Electronics Engineering	4 – 0 – 2	150
CAI-302	Computer Programming with C/C++	3 – 0 – 4	150
CAI-303	Digital Circuits	3 – 1 – 2	150
			800

Module: Diploma Batch: CAI Semester: 4th

Course Code	Name of the Course	L-T-P	Total Marks
CAI-401	Basic Electrical Circuits	3 – 0 – 2	150
CAI-402	Electrical Machines and Control	3 – 0 – 2	150
CAI-403	Instrumentation and Process Control	3 – 0 – 2	150
CAI-404	Electronics Circuits & Devices-I	3 – 1 – 2	150
CAI-405	Electronic Components & Materials	3 – 0 – 0	100
			700

Module: Diploma Batch: CAI Semester: 5th

Course Code	Name of the Course	L-T-P	Total Marks
CAI-501	Control Systems	3 – 1 – 2	150
CAI-502	Generation, transmission & distribution of power	3 – 1 – 0	100
CAI-503	Principles of Instrumentation	3 – 0 – 2	150
CAI-504	Power Electronics	3 – 0 – 2	150
CAI-505	Microprocessors and Applications	3 – 0 – 2	150
CAI-506	Electronic Circuits and Devices-II	3 – 1 – 2	150
			850

Module: Diploma Batch: CAI Semester: 6th

Course Code	Name of the Course	L-T-P	Total Marks
HU-601	Industrial Management & Entrepreneurship	3 – 0 – 0	100
CAI-601	Biomedical Instrumentation	3 – 0 – 2	150
CAI-602	Transducer & Signal Conditioning	3 – 0 – 2	150
CAI-603	Substation, Switchgear & Protection	3 – 0 – 0	100
CAI-61*	Elective	3 – 1 – 0	100
CAI-699	Project, Seminar	0 – 0 – 10	200
			800

Elective Papers:

CAI-611 Telematics & Satellite Communication
 CAI-612 Industrial Instrumentation

THIRD SEMESTER

COMPUTER APPLICATION

Code: Co-301

Theory: 70 marks

L – T – P:

Total Marks: 100

Sessional: 30

2 – 0 – 6

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1. Computer Fundamentals: Brief history – Babbage machine, Von Neumann. Architecture – Block diagrams, Role of Operating Systems, concept of language and language translators, editors. Memory – different types, functions, concept of I/O devices.
 2. Number System: Number system and codes: Decimal, binary, octal, hexadecimal number systems and conversion from one system to another, arithmetic operations using these numbers. Representation of a negative number in the different number systems. Complement and complement subtraction. Different codes: ASCII, 8421, Ex-3, 2421, gray, Alpha-numeric, BCD, Seven segment codes etc. and code conversion.
 3. Introduction to Operating System: Concept of resource management, single user and multi user OS, Various popular OS (DOS, Windows, Unix/ Linux), elementary commands.
 4. Introduction to Internet: Fundamentals of networking – need of network topology, concept of LAN, WAN, MAN, network devices – NIC, hub, bridge, switch, repeaters, gateway, modem, transmission media. Internet services, concept of global net, different browsers, search engine.
 5. MS – Office: Various products, their introduction and uses.

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COMPUTER APPLICATION PRACTICAL

Code: Co-301 (P)

Practical: 25

Total Marks: 50

Sessional: 25

1. Introduction to MS Office: Basic feature of MS Office, Overview of different Office Tools.
2. Introduction to MS Word: Creating and editing document, formatting documents, working with Tables, Spell checking, Mail Merging, Importing Graphics into word Document.
3. Introduction to MS Excel: Creating a new work book, entering labels, values and formulas, formatting the layout, working with functions, creating chart from data writing macros.
4. Introduction to Power Point: Creating a presentation, adding/ editing text, working with objects, formatting the presentation, placing the chart in slide, slide show and printing.
5. Introduction to MS Access: Creation of database. Creation of tables – field declaration, data type declaration, constraint declaration, working with records, querying the data base, joining tables, designing the form, the report.

Reference Books:

1. DOS quick reference: Rajib Mathur
2. Learning Word for Windows : Rajib Mathur
3. Learning Windows step by step: Rajib Mathur
4. Microsoft office unleashed: Techmedia
5. ABC of Office: Han
6. Mastering Excel: Chester
7. Excel 97 Bible: John Walkenbach
8. Teach yourself MS Access in 24 hours: Eddy and Buchanan
9. Microsoft Access 2000 fast and easy: Primatech BBP
10. Unix: S. Das

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ENGINEERING ECONOMICS & ACCOUNTANCY

Code: Hu-302

Theory: 70

L – T – P:

Total Marks: 100

Sessional: 30

3 – 0 – 0

PART A: ENGINEERING ECONOMICS

1. Introduction to Economics and its utility and scope of study.
2. Meaning and definition of utility, consumption, want value, price of goods, national income.
3. Meaning of wealth and its characteristics, classification of wealth.
4. Basic laws of demand and supply and its limitations.
5. Meaning and factors of production, land labour, capital and organisation, factors determining efficiency of labour.
6. Scale of Industries: types, advantages and disadvantages of large and small scale industries.
7. Unemployment: causes of unemployment in India and its remedies.

PART B: ACCOUNTANCY

8. Definitions, objects and principles of double entry book-keeping.
9. Transactions, classification of accounts, rules of credit and debit.
10. Journal and Ledger: Definition, posting and balance of accounts.
11. Cash Book: Single column, double column, triple column cashbook, impress system of petty cash book.
12. Trial Balance: Object of Trial balance preparation, types of errors.
13. Final accounts: preparation of trading account, profit and loss account and balance sheet.

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MATHEMATICS – III

Code: Sc-303

Theory: 70

L – T – P:

Total Marks: 100

Sessional: 30

3 – 2 – 0

GROUP A: DIFFERENTIAL EQUATIONS

- 1.0 Differential Equations: Definition and classification, order and degree, importance of differential equations in Engineering Field.
 - 1.1 Formation of ordinary differential equations.
- 2.0 Equation of the first order and of first degree with reference to Engineering.
 - 2.1 Separation of variables, equations reducible to variable separable form.
 - 2.2 Homogenous equations and its special form.
 - 2.3 Exact equation.
 - 2.4 Integrating factors – definition and rules of determining integrating factors.
 - 2.5 Linear equations and its solution.
 - 2.6 Bernoulli's equation.
- 3.0 Equations of first order but not of the first degree.
 - 3.1 Left hand side resolvable into factors
 - 3.2 Left hand side not resolvable into factors
 - 3.3 Clairaut's equation.
 - 3.4 Practice on units 3.1, 3.2, 3.3
- 4.0 DIFFERENTIAL EQUATIONS OF SECOND ORDER WITH CONSTANT CO-EFFICIENTS
 - 4.1 Linear equations with right hand number zero: introduction to operator D. Auxiliary equation having real and distinct roots, having equal roots, having a pair of complex roots.
 - 4.2 Equations with right hand member as an algebraic expression, trigonometric and exponential functions of X. Solution of linear equations: general and particular integral, complementary functions.
 - 4.3 Engineering application of differential equations such as L-R circuit, L-R-C circuit, Simple Harmonic Motion, Rate of growth and decay etc.

GROUP B: GRAPHICS

1.0 INTRODUCTION AND ITS CONCEPT

- 1.01 Graphical solution of equations.
- 1.02 Cubic equation (one part cubic and the other part linear)
- 1.03 Quadratic equations

1.04 Trigonometric equations

2.0 DETERMINATION OF LAWS OF FITTING OF CURVES

Linear, Quadratic, Exponential, Binomial etc.

GROUP C: STATISTICS

1.0 INTRODUCTION AND ITS APPLICATIONS IN ENGINEERING FIELD

2.0 MEASURES OF CENTRAL TENDENCY

2.01 Mean, median and mode (with illustration)

2.02 Relation between them, the empirical formula.

3.0 MEASURES OF DISPERSION

3.01 Range, Mean Deviation and Standard deviation (with illustration)

3.02 Variation and coefficient of variation

4.0 CORRELATION

4.01 Meaning of correlation as a bi-variate relation, scatter diagram.

4.02 Karl Pearson's correlation formula for two variables

4.03 Determination of correlation by Karl Pearson's formula with reference to engineering applications.

5.0 PROBABILITY

5.01 Introduction to Probability

5.02 Events: mutually exclusive events, exhaustive events etc.

5.03 Definition of probability

5.04 Addition and Multiplication laws of probability

5.05 Examples on probability.

GROUP D: ANALYTICAL GEOMETRY OF 3-DIMENSIONS AND INTRODUCTION TO VECTOR ANALYSIS

1.0 INTRODUCTION AND DEFINITIONS

1.1 Three dimensional rectangular Cartesian co-ordinates, co-ordinates of a point in space with reference to vectors, addition and subtraction formula.

1.2 Coordinates of a point which divides a straight line in a given ratio.

1.3 Distance between two points.

2.0 DIRECTION RATIOS AND DIRECTION COSINES WITH REFERENCE TO VECTORS

- 2.1 Definition of direction ratios and direction cosines
- 2.2 Properties of direction ratios and direction cosines
- 2.3 Relation between direction ratios and direction cosines
- 2.4 Angle between two lines in vector form
- 2.5 Condition of perpendicularity and parallelism.

Recommended books:

1. Integral calculus: Das & Mukherjee
2. Engineering Mathematics: Shanti Narayan
3. An Introduction to Statistics (Vol. I&II): L. Choudhury
4. An easy approach to statistics: S.P. Gupta
5. Analytical Solid Geometry: Misra & Misra
6. Higher Secondary Mathematics: B.S. Grewal
7. Vector & Mechanics: Mena & Mishra

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PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

Code: CAI-301

L – T – P: 4 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

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1. Effect of electric current, electromagnetism, AC circuits using RL & C, Single Phase and three Phase circuits. Batteries: Types of cells and basic operation of – Lead acid, Ni-Cd, Nickel- alkaline cells. Charging and maintenance.
 2. Elementary idea of rotating electrical Machines. Transformer, Working –Principle, types, rating.
 3. Resistors, Capacitors & Inductors, Definitions, types (fixed and Variable) Color Code, ratings Specials components: Thermistor, VDR, LDR and its use.
 4. Semiconductors: Intrinsic & Extrinsic, PN junction diode, diode ratings. Application of diodes: half and full wave rectifier filter, clipping and clamping, voltage multiplier etc. Special diodes : Zener diode, LED, Varistor diode, photo diode, solar cell principles and uses.
 5. Transistor: Definition, pnp and npn types CE, CC, CB, Amplifier circuits. Introduction to SCR, characteristics and applications. Oscillators: Definition with example circuits. Digital electronics: Elementary Ideas on binary nos. and logic gates (AND, OR, NOT) ICs PIN configuration of some specific ICs.

References:

1. Thereja B.L. S. Chand & Co., New Delhi. Ed. 1998: A Text Book of Electrical Technology (Vol. - I)
2. E Norman Lurch, John Willey & Sons, NY. Ed. 1996: Fundamental of Electronics
3. Malvino A.P. Tata Mc Graw Hill, New Delhi. Ed. 1988: Electronics Principle
4. S.K. Bhattacharjee, New Age International, New Delhi: Experiments in Basic Electrical Engineering

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COMPUTER PROGRAMMING WITH C/C++

Code: CAI-302

L – T – P: 3 – 0 – 4

Total Marks: 100

Theory: 28/70

Sessional: 15/30

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1. Introduction, Salient features of C, C-tokens, data types of variables, declarations, type casting and expression Control flow-branching & looping.
 2. Functions-pass by value, Pass by reference and program structure, string manipulation, pointer and array, passing pointers as arguments in function.
 3. Structural input and output file and handing, UNIX system interfaces, special features of C
 4. Object oriented programming, data encapsulating, inheritance and overloading.
 5. File handing with C++, constructors, destructor, special features of C++

References:

1. Balaguruswamy, Tata McGraw Hill, New Delhi: Programming in ANSI C
2. Byron Gottfried, McGraw Hill International, New York: Programming with C
3. Kernighan B W & Ritchie Denison, prentice Hall of India, New Delhi: The C Programming Language
4. Robert Lafore, Galgotia publications, new Delhi: Object Oriented Programming in TURBO C++

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DIGITAL CIRCUITS

Code: CAI-303

L – T – P: 3 – 1 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Binary number system, Logic gates (and, or, not Ex-or, Nand, nor) Boolean algebra, Adder, Subtractor circuitry, number system and code conversion, ASCII code, Gray code, excess-3 code
2. Transistor as a switching element, Combination circuits design.
3. SOP pos, Logic minimization using Karnaugh map method and Quine Mcclausky tabulation method
4. Multiplexer: 16-to-1 Mux, Nibble mux, Demux: 1 to 16 demux. 1-of-16 Decoder, BCD to decimal decoder, seven segment decoder, Encoders: decimal-to-BCD encoder. Parity generators-checkers, RAM, PROM, EPROM
5. PAL Flip-Flops (R-S F-F, DF-F, JK F-F, JK Master slave f-f). Register: types of register, ring counter, Counters: Asynchronous counters, synchronous counters Mode counters, presettable counters, shift+counters. Digital logical families DTL, TTL, ECL, BCL, CMOS, Fanin, Fan out

REFERENCES:

1. Moms Mano, Prentice Hall of India, New Delhi: Digital Logic and Computer Design
2. Malvino, Tata McGraw Hill New Delhi: Digital Computer Electronics
3. Bartee, McGraw Hill, New York: Digital Computer Fundamentals

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FORTH SEMESTER

BASIC ELECTRICAL CIRCUITS

Code: CAI-401

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

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1. Introduction to Circuit Elements-Resistance, Capacitance & Inductance & their behaviour with AC & DC Different types of sources & equivalent conversions. Test Signals, Assumptions for circuit analysis, and classification of Elements.
 2. Two-port: parameters, Mesh and nodal analysis: Nodal Analysis, Mesh Analysis, Net Work Equations for R-L-C circuits and mutually coupled circuits, Star/Delta Transformations.
 3. Network Theorems – Superposition, Thevenin's, Norton's Reciprocity, Maximum power Transfer, Tellegen's Substitution, Compensation and Millman's Theorem.
 4. Electrical Transients (Response of simple Net Works): DC and AC Transients in R-L circuit, DC and AC Transients in R-C circuit, RLC or double energy Transients, Sinusoidal Steady-State Analysis (Single-Phase AC Circuits): Phasor Algebra, Response of General Networks, Resonance in series & parallel circuits.
 5. Polyphase circuits: Three-phase voltage, current & power, Star and Delta connected circuits, Balanced & unbalanced 3 –phase circuits.

References:

1. Theory & Problems of Electric Net Works: B. R. Gupta, S. Chand & Co. Delhi.
2. NetWorks & Systems: D. Roy Choudhury, New Age International, New Delhi.
3. Problems in Electrical Engineering: Parker Smith, CBS Publication, New Delhi.
4. Electrical Circuits: J. A. Edminister, Schaum Series, Tata McGraw Hill.

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ELECTRICAL MACHINES AND CONTROL

Code: CAI-402

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

Electrical Machine is a subject where a student will deal with various types of electrical machines which are employed in Industries, power stations, domestic and commercial appliances etc. After studying this subject, diploma holder in Instrumentation & Control must be competent to repair & maintain these machines & give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

DETAILED CONTENTS

1. Three Phase Supply: Advantage of three-phase system over single-phase system. Star Delta connections. Relation between phase & line voltage & current in a three phase system. Power & power factor in three-phase system and their measurements.
2. Transformers: Principle of operation and constructional details single phase and three-phase transformer, core type & shell type transformers, difference between single phase & three phase transformers, advantages & disadvantages. Voltage Regulation of a transformer. Losses in a transformer. Efficiency, condition for maximum efficiency & all day efficiency. Auto Transformers & Instrument Transformer, CTs & PTs (Current Transformer & Potential transformer)
3. Introduction to Rotating Electrical Machines: E.M.F induced in a coil rotating in a magnetic field, Definition of motor & Generator. Basic principle of a generator & a motor. Torque due to alignment of two magnetic fields & the concept of Torque angle. Basic Electromagnetic laws. Common features of rotating electrical machines
4. DC machines: Principle of working of DC motors & DC generator, their constructional details. Function of the commutator for motoring & generating action. Armature winding. Factors determining induced e. m. f., Factors determining Electromagnetic torque. Armature reaction & its compensation. Action & Relationship between terminal voltage and induced e. m. F., Factor determining the speed of a DC motor. Different type of excitation. Performance & characteristics of different types of DC Machines. Starting of DC machines, motors & starters. Application of DC machines.
5. A. C. Motors: Brief Introduction about three phase induction motors, its principle of operation. Types of induction motors & constructional features of squirrel cage & slip-ring motors. Starting & speed control: Star Delta & DOL (Direct-on-line) starters. Reversal of direction of rotation of 3-phase induction motors.

6. Applications of induction motors: Synchronous Machines. Synchronous generators. Synchronous motors & their applications
7. Single phase & Fractional Kilowatt Motors: Introduction, Principle of operation of single phase motors, Types of single phase induction motors & their constructional details (i.e. phase, capacitor start, capacitor start & run, shaded pole & reluctance start). Single phase synchronous motors – reluctance motor (hysteresis motor). Commutator type single-phase motor – Repulsion Induction motor, shaded pole motors, AC series motor & universal motors. Induction to servo- motors & stepper motors.

LIST OF PRACTICALS:-

1. To Measure power factors in 3 phase system with
 - A) Balance Load
 - B) Unbalanced load by the two wattmeter method & any other methods
2. To draw the equivalent circuit of a transformer & to determine efficiency & regulation by performing:
 - a) Open circuit test
 - b) Short circuit test
3. To measure the Induced e. m. f. of a separately excited d. c generator as a function of field current.
4. To measure the terminal voltage of a separately excited d. c. generator as a function of load current.
5. To measure the terminal voltage of a d. c. shunt generator as a function of load current.
6. To measure the speed of a separately excited d. c. motor as a function of load torque at rated armature voltage.
7. To measure the speed of a separately excited D. C. as a function of load torque at rated armature voltage
8. To measure the speed of a D. C. series motor as a function of load torque at rated armature voltage
9. To determine the efficiency of a D. C. shunt motor by the measurement of losses (Sunburn's method)
10. To observe the difference in the effect of switching on a single- phase capacitor start induction motor with.
 - a) The capacitor disconnected and
 - b) The capacitor connectedAlso to determine how to reverse the direction of rotation
11. Measurement of power and power factor in a 3 phase circuit by two wattmeter method.

INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must be organized to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory with minimum possible assistance of the factory staff.

References:

- 1) Electrical Machine by SK Bhattacharya, Tata McGraw Hills, New Delhi
- 2) Electrical Machine by Nagrath & Kothari, Tata McGraw Hills, New Delhi
- 3) Experiments in Basic Electrical Engineering: by SK Bhattacharya, KM Rastogi: New Age International (p) Ltd. Publishers, New Delhi
- 4) Electrical Machines by SK Sahdev, Unique International Publication Jalandhar
- 5) Electrical Technology Vol. – I & II B. L. Thareja, S Chand & Co. New Delhi.

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INSTRUMENTATION AND PROCESS CONTROL

Code: CAI-403

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Fundamental & Importance of Instrumentation, types of instruments, selection of instruments, performance of instruments, error in measurement, calibration & standard, Calibration of Instruments: Methods & analysis, Introduction to Transducer & types, Process Instrumentation, recording instruments, indicating & recording Instruments.
2. Measurements of temperature, pressure, relative humidity, moisture content & velocity & flow.
3. Miscellaneous measurement: force & torque, level, pH, gas analyzer, emissivity, refractive index, viscosity, surface tension, & color. Spectro-photo-metry, chromatography & NIR Introduction to biosensors.
4. Basic concept of process controls, types of control & their application. Concept of automatic control & its classification, Instrumentation & control of typical food processing units like reactor, evaporator, dryer etc.

References:

1. Experimental Methods - J. P. Holman McGraw Hill International, Auckland.
2. Engineering Metrology - R K Jain, Khanna Publishers, Delhi.
3. Mechanical Measurements - Thomas G. Beckwith & Lewis Back N. Adison Wesely Longman, Harlow.
4. Industrial Instrumentation - John Wiley Eastem Ltd, New Delhi.

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ELECTRONICS CIRCUITS & DEVICES-I

Code: CAI-404

L – T – P: 3 – 1 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Introduction to class A, B, and C amplifier Circuits, Simple calculation of voltage/ Current gain (using simplified pi model), Input/ output impedance, power amplifier, elementary idea on feedback amplifier with example circuits and properties.
2. Basic theory of oscillators: Operation of Colpitts and Hartley Oscillators, Other oscillators configurations and their specific applications. Introductory idea and uses of multi-vibrators: A stable, Mono-stable and Bi stable.
3. Elementary ideas of Op-amp, Introduction to op-amp, uses of op-amp as inverting amplifiers adder subtractor, integrator and differentiator
4. FET: JFET introductory ideas, MOSFET: Structure, physical behavior, I/V characteristic, NMOS, PMOS, CMOS, MOS amplifiers and logic gates.
5. Multivibrators: A-stable Mono-stable and Bi-stable circuits. Detailed analysis and design with discrete components. Designing with ICs with logic gates

References:

1. Basic Electronics and linear Circuits - N. N. Bhargava D. C. Kulshreshtha, S. C. Gupta, Tata McGraw Hill, New Delhi.
2. Electronics Principles - A. P. Malvino, tata McGraw Hill, New Delhi.
3. Micro Electronics - J. Millman, Arvin Gabel, Tata McGraw Hill, New Delhi.
4. Integrated Electronics - J. Millman, & C. C. Halkias, Tata McGraw Hill, New Delhi.

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ELECTRONIC COMPONENTS & MATERIALS

Code: CAI-405

L – T – P: 3 – 0 – 0

Total Marks: 100

Theory: 28/70

Sessional: 15/30

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- 1. Conducting Materials:** Effect of temperature on resistivity of different materials: Properties and uses of Tantalum, Thorium, Molybdenum, Nickel, Nichrome, Constantan, Manganese, Carbon, Graphite etc. Metals and alloys for uses. Properties and specification of wire, cable and antenna materials. Resistors: Constant type: Types, Construction and uses. Variable type: Types, Construction and uses. Special type: Thermistor, VDR, LDR their construction and uses. Inductors: Self and mutual inductance, types of cores, variable inductance, construction of relays and uses. Capacitors: Types, Construction, rating and uses. Transformers: Types, construction, uses of cores and their applications. Storage Cells: Detailed discussion on solid State cells (e. g. Nick cell).
 - 2. Integrated Circuits:** Introduction, classifications, various types of packing.
 - 3. Insulating Materials:** Static dielectric constant, polarization and dielectric constant, atomic interpretation of dielectric constant of mono atomic gases and poly atomic molecules, internal field in solids and liquids, general feature of static dielectric constants of solids, static dielectric constant of solids properties of ferroelectric materials, spontaneous polarization of ferromagnetic materials, piezo electricity and piezoelectric materials. Dielectric properties In Alternating Fields: Frequency dependence of electronic and ionic polarizability, complex dielectric constant, dielectric relaxation and losses, temperature dependence.
 - 4. Magnetic Materials:** Classification of magnetic Materials, diamagnetism, para-magnetism, ferromagnetism, anti-ferromagnetism, ferromagnetism, Weiss field & magnetic domains, Magnetic energy: Hard & Soft magnetic materials: Iron-silicon-nickel alloys, soft ferrites & garnets, hard magnets, magnetic tapes and films, magnetic materials uses at high frequencies.
 - 5. Electrostatic and Electromagnetic Shielding:** Effect of Electrostatic and electromagnetic field on electronic devices and circuits, types of shielding and materials uses for shielding.
 - 6. Ceramics:** Classification of ceramics, properties and uses. Special Materials and Chemicals: Soldering wires and grades, contact materials used in semiconductors, chemicals used for cleaning the contacts. Superconductors: Introduction to Superconductors. Various Superconducting materials and their applications

References:

1. The Structure and Properties of Materials, Vol. – 4: R. M. Rose, L. A. Shepard, J. Wulf, Wiley Eastern ltd., New Delhi.
2. Electronic Engineering Materials and Devices: John Allyson, Tata McGraw Hills, New Delhi.
3. Introduction to Material Science for Engineers: James Shakelfork, MacMillan Publishing Co., New York.

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FIFTH SEMESTER

CONTROL SYSTEMS

Code: CAI-501

L – T – P: 3 – 1 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

It is pre-requisite for the students to know the various total plants control in the process industry. An automatic control systems saves manpower, reduces cost of production, increases the accuracy of the finished product and helps in mass production so that the knowledge of this subject is required to have deeper grasp of the control environment/ techniques as need to be studied in the subjects e.g. process control, process instrumentation

DETAILED CONTENTS

1. Introduction

Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, basic elements of a servo mechanism. Example of automatic control systems, use of equivalent systems for system analysis, liner systems, non-liner systems control systems examples from chemical systems. Mechanical systems, electrical systems, introduction to lap lace transform.

2. Transfer function analysis of AC and DC servomotors synchros. Stepper motor, amply dyne, AC position control system, magnetic amplifiers

3. Control system representation: Transfer function, block diagram reduction of block diagram, problems on block diagram, Mason's formula signal flow graph

4. Time response Analysis: Standard test signals, time response of first and second-order system, time constant, time response of second order system, time response specifications. Steady- state errors and error constants, problems in first and second order system

5. Stability: Routh Hurwitz Criterion, Root Locus, Bode plotting using semi log graph paper

LIST OF PRACTICALS

1. Study of characteristic of servomotor
2. Characteristics and speed control of a stepper motor

3. To demonstrate the synchro characteristic and use a synchro pair error detector
4. Characteristics of a potentiometer
5. Study of speed control of motor with tachometric feedback.
6. Design of a DC speed control system
7. Simulation of a position control system with PC
8. Study of ON-OFF controller

RECOMMENDED BOOKS:

1. Control System by Nagrath and Gopal
2. Control System by Kuo
3. Control System by Ogata

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GENERATION, TRANSMISSION & DISTRIBUTION OF POWER

Code: CAI-502

L – T – P: 3 – 1 – 0

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Thermal power station: Introduction, selection of site, main parts and working principle, i.e. (boiler - Economizer), Air pre-heater, super heater, Re-heater, Steam prime Mover, condenser, spray pond cooling Tower, fuels solid, and gaseous Fuels.
2. Hydroelectric station: introduction, selection of site, classification based on quality of water, head and load, General lay out and operation. Construction and operation of different components i.e. Dam, spillways- Gates, Canal, penstocks, Water Hammer, surge tank, types of Turbine.
3. Nuclear power station: Introduction, selection of site, Elements of nuclear power station. Types of nuclear reaction, Nuclear reaction, Nuclear reactor and its function, coolant cycle, reactor control, Fast Breeder Reactor
4. Gas turbine plant: Introduction, components of Gas turbine plant, Fuel for Gas, plant lay-out and working principle. Comparison of various types of power plants: diesel electric station: Introduction, site selection, components of diesel Electric plant working principle
5. Short and medium transmission line, Current and voltage relation, power flow through a Transmission line, performance of short transmission lines, mechanical design of transmission line, Distribution system: Different types of supply system and their comparison. DC/AC Distribution system

Reference Books:-

1. Electrical Power - Soni, Gupta & Bhatanagar, dhanpath Rai and Sons, Delhi
2. Electrical Power - S.L. Uppal, Khanna publications, Delhi
3. Electrical power - C.L. Wadhwa, New Age International, New Delhi

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PRINCIPLES OF INSTRUMENTATION

Code: CAI-503

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

The syllabus has been designed to integrate the basic knowledge to make the base of understanding instrument technology. The basic principles involves in instrumentation system, displays etc. are included in the syllabus. This concept will help the students to pick up the higher knowledge which is to be imparted in the following years. The faculty may give some assignments and arrange for industrial trips

DETAILED CONTENTS

1. Basic building blocks of any instrumentation systems

- Scope and necessity of instrumentation
- Name of important process variables, their units
- Building blocks instrumentation systems
- Various testing signals

2. Performance characteristics of Oscillator Instruments

- Static and dynamic characteristics of instruments
- Concept of time constant, response time, natural frequency, damping co-efficient -Order or instruments (1st and 2nd order) with industrial applications
- Ramp, sinusoidal, step response of different order of instruments systems
- Analytical execution

3. Display and recording devices

- Operating mechanism in indicators and recording devices
- Various indicating, integrating and recording methods and their combination
- Merits and demerits of circular chart and strip chart recorder
- Basic of printing devices
- Scanning, data logging and field buses
- Bar graph LDC, Seven segment display, X-Y recorder, scanners
- Design experiments for display systems

4. Instrument selection

-Factors effecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability, loading effect, range advantage and limitation, cost effectiveness and availability

-Static and dynamic response

-Environmental effect

-Calibration tools

5. Errors

-Sources and classification of errors, the remedial action

-Grounding, earthing, guarding and shielding

-Precaution

-Analytical execution

LIST OF PRACTICALS

1. To find the constant of 1st order instrument

2. To find the constant of 2nd order instrument

3. To find the response of 1st order instrument with step, sinusoidal and ramp input

4. To find the response of 2nd order instrument with step, sinusoidal and ramp input

5. To assemble seven segment display using LEDs

6. To make fourteen segments display using LCD and verify it

7. To make the DOT Matrix display and its verification

8. Make any word using LCD and LED

9. To study and circular and strip chart recorder

RECOMMENDED BOOKS

1. Mechanical and Industrial Measurement of by RK Jain, Khanna publisher publishers, New Delhi

2. Industrial Instrumentation by Donald P Eickrman

3. Electrical and Electronics Measurement of by AK Shawney, Dhanpath Rai and Company, New Delhi

4. Advanced Instrumentation and Control by MF Kureshi

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POWER ELECTRONICS

Code: CAI-504

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

Power Electronics play a very vital role in the field of electronics and controlled engineering. It is specially applied in the modern industries as they mostly use efficient, effective and precise controls as the old magnetic and electrical control schemes have largely become obsolete. A diploma holder in electronics and instrumentation and control has to maintain the panels used in modern controlled processes. It is obvious that the knowledge of components such as thyristors, and other semiconductor devices used in such control circuits is very essential for them in order to supervise the work efficiently and effectively. Looking into its usefulness and importance, this subject has been incorporated in the curriculum

DETAILED CONTENTS

1. Introduction to thyristors and other power Electronics devices-

Construction, working principles of SCR two transistor analogy of SCR, VI characteristics of SCR; SCR specifications and ratings; Different methods of SCR Triggering; Different commutation circuits for SCRs; Series and parallel operations of SCRs; Basic idea about the selection of heat sinks for thyristors; Construction and working principle of Diacs and Triacs and their V-I characteristics; Construction, workings and ratings of Gate Turn off (GTO) thyristors; Characteristics of SCR diac. Triac, programmable uni-junction transistor (PUT), ASCR, RCT, LASCR, SCS ; Contribution and working of UJT and its application as relaxation oscillators; Comparison between BJT and SCR; Construction, working and characteristics of MOSFET, IGBT, MLT, their specifications and ratings

2. Application of SCR and Triacs: Illumination control; Temperature control; Battery charger; Fan regulators; Emerging light using SCR; Speed control of DC and universal motor; LDR operated SCR circuit; Switched mode power supply; Uninterrupted power supply; Solid state relays

3. Controlled Converters: Half wave controlled rectifier with resistive load; Half wave ; controlled rectifier with inductive load; Full wave half controlled rectifier with resistive load; Full wave half controlled rectifier with inductive load; Full wave fully controlled rectifier with resistors as well as inductive load; Three-phase half wave fully controlled rectifier with resistors as well as inductive load; Three phase fully wave fully controlled and half controlled with resistive as well inductive loads; Dual converters and their applications.

4. Inverters: Voltage and current source inverters; Working principle of single phase series and parallel inverter; Working principle of single phase bridge inverter; Working principle of three phase bridge inverter.

5. Choppers: Working of voltage, current and load, commutated choppers; Classification of choppers.
6. Cyclo Converter: Working principle of single phase and three phase cyclo converter.
7. Electric Device Control: D. C. drive control - Speed control of dc series motor using bridge rectifier; Speed control of dc shunt motor using bridge rectifier; Speed control of dc motor using choppers; Study of control scheme for speed control of a separately excited dc motor above and below the base speed; AC drive control - Speed control of induction motor using phase control; Speed control of induction motor using variable frequency; Speed control of induction motor using slip power recovery schemes

LIST OF PRACTICALS

1. Testing of components like SCR Triac, BJT, UJT, and MOSFET
2. To plot and verify V-I characteristics an SCR
3. To plot and verify V-I characteristics of a Triac
4. To plot V-I characteristics of UJT
5. To plot V-I Characteristics of a DIAC
6. Fabrication and testing of illumination control circuit using SCR
7. Fabrication of street lights circuits using LDR and Triac
8. Fabrication of speed control circuit for a dc motor
9. Fabrication of three phase bridge rectifier using two SCR and two diodes
10. Fabrication of three phase bridge rectifier using diodes
11. Fabrication of Transistorized emergency light cum battery charger circuit

INSTRUCTIONAL STRATEGY

The teacher may encourage students of perform practical simultaneously for better understanding of the subjects and verification of theoretical concepts. The various components must be shown to the students for identification and also tested. Practical application of the various circuits and devices should be discussed in the class. The available video films on the subject must be shown to the students.

RECOMMENDED BOOKS

1. Industrial Electronics and Control by SK Bhattacharya and S Chetterji; New Age publishers, New Delhi
2. Electrical and Electronic Measurement by A.K. Sawhney, Dhanpat Rai and Sons, New Delhi
3. Power Electronics – Principle and Application by J Michael Jacob; Vikas Publishing House, New Delhi
4. Power Electronics by M.H. Rashid.
5. Power Electronics by P.C. Sen, Tata McGraw Hill Publishers, New Delhi
6. Thyristors by M.S. Berde, Khanna publishers, New Delhi
7. Thyristors and Thyristors by Sugandhi and Sugandhi
8. Power Electronics by P.S. Bhimbhrah, Khanna publishers, New Delhi
9. Fundamentals of power Electronics by S. Rama Reddy, Narosa publishing House, New Delhi

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MICROPROCESSORS AND APPLICATIONS

Code: CAI-505

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Microprocessors Architecture and its operation, Memory Input-Output (I/O), interfacing devices. The 8085/8080A Microprocessors, Instruction classification Instruction format, Example of a simple program, Instruction Timing and operation status, Introduction to 8085/8080A instruction set.
2. Basic Instructions of 8085/8080; Data transfer Instructions, Arithmetic operation, logic operation, Branch operations, Assembly language programming in 8085; Debugging a program
3. Programming with additional Instruction: looping, counting, indexing, Additional Data transfer and 16-bit Arithmetic Instruction, logic operations Rotate and compare counters and time Delays, Hexadecimal counter, pulse Timing for Flashing.
4. BCD to Binary code conversion, Binary to BCD to seven-segment LED code conversion, BCD Addition and Subtraction introduction to advanced instruction and Application, Multiplication and subtraction with carry
5. Basic Interfacing Concept, Interfacing input Keyboard, Memory-mapped I/O, 8085 interrupt, D-A and A-D Convertor, 8255A programmable peripheral Interface, 8253 Programmable interval Timer, Basic concept of Serials I/O, software controlled Asynchronous serial I/O, SID, SOD, Hardware – controller serial I/O using Programmable chips.

REFERENCE BOOKS:-

1. Microprocessors Architecture, programming and Applications With 8085/8080A - R.S. Gaonkar, Wiley Eastern Limited, New Delhi
2. Introduction to Microprocessors - Mathur, Tata McGraw Hill, New Delhi
3. Microprocessors Technology and Microcomputers - Pashow, Mc-Graw Hill. Inc., New York

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ELECTRONIC CIRCUITS AND DEVICES-II

Code: CAI-506

L – T – P: 3 – 1 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Analysis of BJT amplifiers, differential amplifiers
2. Introduction to op-amp: CMRP, op-amp buffer half wave and full wave rectifier, active filter, performance comparison of typical op-amp (741, LM411, LM118, LM108, QD611)
3. Regulated power supply Design: Capacitive filter power supply, single Op-amp regulator three terminal regulator, adjustable power supply, line powered terminator IC (LM 117, 217, 317, 78XX, 79XX), Switch capacitor voltage conversion (LM660). Switching power supply, Basic principles, Buck regulator, Boost regulator
4. Tuned amplifiers: Single tuned circuit, FET & BJT amplifiers, op-amp tuned amplifier, Tuned transistor amplifier with tuned load, Narrow band approximation and tuning (synchronous & Stagger), Cascade tuned amplifier, Design of tuned amplifier, oscillation possibility and sensitivity. Oscillators: Wien Bridge, phase shift, twin T and Crystal oscillators
5. Feedback amplifiers: Classification of feedback amplifiers, feedback concept, Principles of operation of four types of feedback amplifiers (voltage series/shunt, current series/ shunt). Input impedance, output impedance, advantage and disadvantages.
6. Introduction idea and uses of SCR, Diac, Triac, and UJT, Integrated circuit: Introduction to IC, familiarization with popular ICs 555, 7400, 7402, 7406, audio and video amplifier.

REFERENCE BOOKS:-

1. Basic Electronics and Linear Circuits - N.N. Bhargava, D. C. Kulshreshta, S.C. Gupta McGraw Hill, New Delhi
2. Electronics Principles - A.P. Malvino, Tata McGraw Hill, New Delhi
3. Micro Electronics - J. Millman, Arvin Grabal, Tata McGraw Hill, New Delhi
4. Integrated Electronics - J. Millman, & C. C. Hlaskas, Tata McGraw, New Delhi
5. Solid State Devices - B. Streetman, prentice Hall of India, New Delhi

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SIXTH SEMESTER

PROCESS CONTROL AND INSTRUMENTATION

Code: CAI-601

L – T – P: 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Fundamentals and importance of instrumentation, types of instruments, selection of instruments, performance. Of instruments, errors in measurement, calibration and standard. Calibration of Instruments: Methods and analysis. Introduction to Transducers and types. Process instrumentation, recording instruments, indicating and recording instruments.
2. Measurement of temperature, pressure, relative humidity, moisture content and velocity and flow.
3. Miscellaneous measurement: force and torque, level, pH, gas analyzer, emissivity, refractive index, viscosity, surface tension, and color. Spectrophotometry, chromatography and NIR. Introduction to biosensors.
4. Basic concept of process controls, types of control and their application. Concept of automatic control and its classification. Instrumentation and control of typical food processing units like reactor, evaporator, dryer etc.

REFERENCE BOOKS:-

1. Experimental Methods, J.P. Holman McGraw Hill International, Auckland
2. Engineering Metrology, R KJain, Khanna Publishers, Delhi
3. Mechanical Measurements, Thomas G. Beckwith and Lewis Back N. Adison Wesely Longman, Harlow
4. Industrial Instrumentation, John Wiley Eastern Ltd, New Delhi

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BIOMEDICAL INSTRUMENTATION

Code: CAI-601

L – T – P : 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

Recent advances in medical field have been fuelled by the instruments developed by the Electronics and Instrumentation Engineers. Pacemakers, Ultrasound Machine CAT, Medical diagnostic systems are few names which have been contributed by engineers. Now health care industry uses many instruments which are to be looked after by instrumentation engineers. This subject will enable the students to learn the basic principles of different instruments/equipment used in the health care industry. The practical work done in this area will impart skill in the use, servicing and maintenance of these instruments/equipment. Proficiency in this area will widen the knowledge and skill of diploma holders in the field of biomedical instrumentation.

DETAILED CONTENTS

1. Anatomy and Physiology

Elementary ideas of cell structure, heart and circulatory system. Control nervous system, Musculo-skeletal system, Respiratory system Body temperature and reproduction system.

2. Classification of Biomedical Equipment

Diagnostic. therapeutic and clinical laboratory equipment

3. Bioelectric signals and their recording

Bioelectric signals (ECG, EMG, ECG, EOG & ERG) and their characteristics, Bio- electrodes, electrodes tissue interface, contact impedance, effects of high contact impedance, types of electrodes, electrodes for ECG, EEG and EMG.

4. Transducers for Biomedical Application

Resistive transducers - Muscle force and Stress (Strain gauge), Spirometer (Potentiont), humidity, (Gamstrers), Respiration (Thermistor)

Inductive Transducers - Flow measurements, muscle movement (LVDT)

Capacitive Transducers - Heart sound measurement, Pulse pick up

Photoelectric Transducers - Pulse transducers, Blood pressure, oxygen Analyses

Piezoelectric Transducers - Pulse pickup. Ultrasonic blood flow meter

Chemical Transducer - Ag-Agfallas (Electrodes, PH electrode

5. Bioelectric Signal recording machines

Physiological pre-amplifier and specialized amplifiers, ECG lead systems details of ECG, EMG, and EEG machines.

6. Patient Monitoring system

Heart rate measurement pulse rate measurement, respiration, rate measurement, blood pressure measurement, microprocessor applications in patient monitoring.

7. X- Ray Machine

Basic X-Ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- Ray machine.

8. Safety Aspect of Medical

Gross current, Micro Current shock, safety standards rays and considerations, safety testing instruments, biological effects of X-rays and precautions

LIST OF PRACTICALS

1. Minimum of eight exercises to be carried out and one field visit
2. Operation and function of all the controls of hospital X-Ray machine (visit at hospital)
3. Operation and function of all the controls of dental X-Ray machine (Visit to Hospital)
4. Identification of different block/sub system of circuits in X-Ray machine
5. Measurement of skin contact impedance and technique to reduce it.
6. Observe its wave shape on CRO the output of blood pressure transducers body temperature transducers and pulse sensors
7. Use of sphygmo-manometer for measurement of blood pressure
8. Concept of ECG system and placement of electrodes
9. Measurement of leakage currents with the help of safety tester
10. PH measurement of given biological sample
11. Concept of EMG system and placement of electrode
 12. Measurement of respiration rate using thermistor
 13. Concept of EEG system and placement of electrode
14. Identification of different types of PH electrode

RECOMMENDED BOOKS

1. Medical Instrumentation by John. G. Webster -John Wiley
2. Principles of Applied Biomedical Instrumentation by Geddes & Baker - John Wiley
4. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson

5. Biomedical Instrument by Cromwell-Prentice Hall of India. New Delhi
6. Hand book of Medical instruments by R.S. Khandpur-TMH, New Delhi
7. Medical Electronics and Instrumentation by Sanjay Guha - University Publication
8. Introduction to Biomedical electronics by Edward J. Bukstein -sane and Co. Inc. USA

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TRANSDUCER & SIGNAL CONDITIONING

Code: CAI-602

L – T – P : 3 – 0 – 2

Total Marks: 100

Theory: 28/70

Sessional: 15/30

RATIONALE

After studying the course the students will be able to identify different types of sensors and transducers and their applications in the field of instrumentation and control. The students will be able to select appropriate transducers relating to a process and will also get the relevant technical know how about the conditioning of a signal from a transducer for the purpose of control. Subject teachers are advised to show the students different types of sensors and transducers while teaching the various topics of this course. Further, teacher's may give some assignment problems related to industrial signal processing and applications which calls for use of specific transducer and signal conditioning equipment in specifications.

DETAILED CONTENTS

1. Basic concepts
Definition and classification of transducers
2. Variable Resistance Transducers Construction, working principle, selection criteria and application of
 - Potentiometer, strain gauge, load cell
 - Hot wire anemometer, photo resistors
 - Resistive temperature transducers
 - Thermistors
 - Carbon Microphones
 - Accelerometer advantages, disadvantage and limitation
3. Variable Inductance transducer construction, working principles, selection criteria and application of
 - Electromagnetic pick up
 - Induction potentiometer
 - Linear variable differential transformer
 - Synchronous transmitter and receivers, advantages, disadvantages and limitations
4. Variable capacitance Transducers
Construction, basis principle selection criteria and application of
 - Capacitance pick up

- Condenser microphone
- Differential capacitor pick up advantages, disadvantages and limitations

5. Piezoelectric Transducers

Construction, basic principle, selection criteria and application of

- Piezoelectric Transducer
- Seismic pick up
- Ultrasonic Transducer
- Advantage, disadvantages and limitations

6. Other types of transducers

- Transducers based upon Hall Effect
- Optical transducers-photo diode, photo transistor LOR, and LED
- Digital transducer-single shaft encoder
- Techo generator
- Advantage and disadvantage and limitations

7. Principle of analog signal conditioning

- Linearization
- Various types of conversions (from V to F, from F to V, V to I converters and I to V converters)
- Filtering and impedance matching
- Advantages, disadvantages and limitations

8. Digital signal conditioning

- A/D conversion
- D/A conversion
- Multiplexer/Demultiplexer
- Encoder/Decoder
- Sample and hold
- Data Acquisition system (DAS)

LIST OF PRACTICALS

1. Study of strain gauge and measurement of strain for a given sample
2. Study of piezoelectric pressure transducer
3. Study of RTD (Resistance Temperature detector)
4. Study of thermistors
5. Study of calibration of LVDT

6. Study of capacitive transducer and measurement of angular displacement
7. Study of magnetic pick up
8. Study and draw the characteristics of a capacitance transducer
9. Study of thermocouple
10. To study and draw the characteristics of following
 - LDR
 - Photo diode
 - Photo transistor
 - Capacitance transducers

LIST OF RECOMMENDED BOOKS

1. Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
2. Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi
3. Transducers by Peter Norton
4. Mechatronics by Bolton, Prentice Hall of India, New Delhi

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SUBSTATION, SWITCHGEAR & PROTECTION

Code: CAI-603

L – T – P : 3 – 0 – 0

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Substation - definition, classification, criterion for site selection, substation equipment, Bus bar-definition, classification.
2. Neutral grounding - definition and difference from equipment grounding, disadvantages of neutral ungrounded system, types of neutral grounding, criterion for neutral ground practice Earthing & Transformer.
3. Introduction to symmetrical components and a symmetrical faults, Relays - classification basic working principle of electromagnetic and induction relay.
4. Introduction to static relays, Application and phase comparator, Basic principles of o/c relays, directional relays distance relays, differential relay.
5. Apparatus protection, transformer protection, motor protection alternator protection, Circuit breakers working principle. Arc interruption theory, auto reclosing, types of CB and its relative advantages and disadvantages.

LIST OF RECOMMENDED BOOKS

1. Switchgear & Protection in Power System, Sunil, s. Rao, Khanna Publishing, Delhi
2. Power System Protection, M.A.Date, B.Oza & N.C.Nair, Bharti Prakashan, Vidyanagar
3. Electrical Power System, C.L.Wadhwa, New Age International, New Delhi
4. Power System Protection & Switchgear, B.Ravindranath & M.Chander, New Age International, New Delhi

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TELEMATICS & SATELLITE COMMUNICATION

Code: CAI-611

L – T – P : 3 – 1 – 0

Total Marks: 100

Theory: 28/70

Sessional: 15/30

1. Introduction of communication Transmission-wire transmission, other transmission media- Fiber optic, Microwaves and Satellites.
2. Transmission quality, error sources, bit-rate signalling, channel capacity, asynchronous and synchronous transmission, error detection and correction schemes.
3. Pulse code modulation-Multiplexing of signals, practical PCM systems-TI/DI system, D2 system, UK-24 and CEPT-30 channel systems. Higher order multiplexing-T2, '1'3 & '1'4, signal to quantization noise, idle channel noise, Uniform coding and Non-uniform coding, practical coding laws-U-law and A-law encoding rules, systems performance.
4. Digital switching-space division switching, multiple-stage switching, Blocking probabilities, Analog and digital time division switching, two dimensional switching-S'TS and TST switching.
5. Principles of digital modulation - Amplitude, Phase and Frequency shift Keying.
6. Communication Networks: E-Mail, EPBX, Teleconferencing, Personal communication, Data communication networks - Message switching. Packet switching, Statistical multiplexing, Introduction to local area networks, Basic ideas of Routing and Flow control, Basics of ISDN.

SATELLITE COMMUNICATION

1. Original of Satellite communications, Orbital mechanics, Launches and Launch Vehicles.
2. Telemetry, Tracking and Command, Power systems, communications subsystems.
3. Spacecraft Antennas, Modulation and Multiplexing Techniques. •
4. Multiple Access Techniques – FDM/FM/FDMA, TDMA, Encoding and error correction for Digital satellite links, propagation on Satellite-Earth Paths and its influence.
5. Earth Stations - Equipment for Earth Stations; Tracking, Insat, Intelsat and Inmarsat.

LIST OF RECOMMENDED BOOKS

1. Telecommunication Switching Systems and Networks, T. Viswanathan, Prentice Hall of India.
2. Data Communication, Computer Network and Open Systems, Fred Halsall, Addison Wesley Longman, Singapore.
3. Satellite Communication, Pratt and Bostain, John Wiley & Sons, Singapore.
4. Satellite Communication, Tri.T.Ha.

INDUSTRIAL INSTRUMENTATION

Code: CAI-612

L – T – P : 3 – 1 – 0

Total Marks: 100

Theory: 28/70

Sessional: 15/30

Measurement of Force, Torque and Velocity

Electric balance – Different types of load cells – Magnets – Elastic load cells - Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter – Capacitive tacho-drag cup type tacho – D.C and A.C tacho generators – Stroboscope.

Measurement of acceleration, vibration, density and viscosity

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick-ups – Units of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer – Viscosity terms – Saybolt viscometer – Rotameter type.

Pressure Measurement

Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor – resonator pressure sensor – Measurement of vacuum – McLeod gauge – Thermal conductivity gauges – Ionization gauge, cold cathode and hot cathode types – Testing and calibration of pressure gauges – Dead weight tester.

Temperature Measurement

Definitions and standards – Primary and Secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – three lead and four lead RTDs.

Thermocouples and Pyrometers

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Response of thermocouple – special techniques for measuring high temperature using

thermocouples – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1999.

REFERENCE BOOKS

1. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.
2. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', Dhanpath Rai and Co, 2004.
3. B.C. Nakra & K.K. Chaudary, 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004.
4. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.
5. D.P. Eckman, 'Industrial Instrumentation', Wiley Eastern Ltd.

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