

Transducers – I

S.E. Sem. III [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	2 Hrs.	50
Oral Exam	–	25*
Term Work	–	25

* - Oral examination will be based on object-oriented industrial visit.

SYLLABUS

1. Instrumentation System

Units and standards of measurement. Introduction, block diagram, functional elements of measurement system, static and dynamic characteristics or performance characteristics of transducer. Error: definition, classification, statistical analysis of errors.

2. Transducer

Definition, classification (active, passive, primary, secondary, mechanical, electrical, analog, digital), selection criteria, sources of error for parameter under measurement, transducer specifications, test condition and operating conditions.

3. Displacement

(a) **Resistance potentiometer** : (linear and logarithmic), piezoresistive effect, ultrasonic transducer. LVDT, RVDT (transfer function, linearity, sensitivity, source frequency dependence, phase null, and signal conditioning). Selection and properties of materials for LVDT and general electromagnetic sensors.

(b) **Capacitance type transducers** : with applications, materials for capacitive, ultrasonic and elastic transducers.

(c) **Digital transducer** : translational and rotary encoders (absolute position and incremental position encoders), Optical and magnetic pickups.

(d) **Pneumatic transducer** : flapper – nozzle transducer.

4. Temperature transducers

Modes of heat transfer, laws of conduction convection and radiation, engineering materials for Temperature and conductive, resistive sensors, properties of materials for RTD, thermister, thermocouple. Temperature scales (standard scale), glass thermometers, liquid expansion thermometer, gas thermometer (filled system thermometer), bimetallic thermometer, solid state temperature sensor.

(a) **Resistance temperature detector (RTD)** : types, construction, errors associated with RTD and its solutions (3 wire and 4 wire method, null balance, power supply stability), self heating effect, sensitivity, response time, dissipation constant, range advantages, disadvantages and limitations.

(b) **Thermistors** : Principle, types (NTC, PTC), characteristics, construction, sensitivity, range, response time, signal conditioning measuring circuit, calibration and applications.

(c) **Thermocouple** : Principle, thermoelectric effect, seebeck effect, Peltier effect, laws of thermocouple, types of thermocouple with characteristic curve, thermocouple table, sensitivity, construction, range, signal conditioning, electrical noise and noise reduction techniques, cold junction compensation method, thermowell, thermopile, thermocouple emf measurement method.

(d) **Pyrometers** : Radiation and optical

5. Level Transducers

Dipsticks, displacers, float system, bubbler, diaphragm bore type, capacitive devices for level measurement, ultrasonic level gauge, DP cell, load cell, vibrating type, microwave, radar, radioactive type level gauges, LASER type transducers, fiber optic level sensors, solid level detectors. Intelligent level measuring instruments.

6. Metrology

Elements of Engineering measurement: Abbas and Taylor's principle, theory of limits and fits and their selection, screw thread measurement, gear profile measurement, absolute and comparative measurement and measuring principle, alignment testing, use of auto collimators and design and use of limit gauges, screw and slip gauges.

Reference :

1. Instrumentation Measurement and Analysis (*B.C. Nakra, K.K. Cahudhary*) Tata McGraw Hill.
2. Electrical and Electronic Measurement and Instrumentation (*Sawney A.K.*) Dhanpatrai & Co.
3. Measurement System (*Doebelin E.D.*) 4th Edition.
4. Process Measurement and Analysis (*Liptak B.G.*).
5. Instrument Transducer (*Neubert Hermann K.P.*) Oxford University Press – New Delhi, 2003 (2nd Edition).
6. Process Control Instrumentation Technology (*Johnson Curtis D.*) 5th Edition.
7. Engineering Metrology (*Jain R.K.*) Khanna Publishers.
8. Instrumentation Systems and Devices (*Rangan, Mani, Sarma*) Tata McGraw Hill (2nd Edition).
9. Heat Transfer (*S.P. Sukhatme*) University Press (3rd Edition).
10. Fundamentals of Test Measurement Instrument Instrumentation (*Cheatle Keith R.*) IS Publication.



Analog Electronics [AE]
S.E. Sem. III [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	2 Hrs.	50
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. **Diode**
Clipper and clamper circuit using diode.
2. **Bipolar Junction Transistor**
Transistor biasing, different types of biasing circuit and their analysis, bias stability, stability factor, comparison of biasing circuits, thermister compensation, thermal runaway.
3. **Transistor Amplifier Analysis and Circuits**
RC coupled amplifier, H– parameters, necessity of hybrid model and h – parameters, determination of h–parameter from transistor characteristics. Approximate conversion formulae for h– parameter for CE, CB, CC configurations, A.C. equivalent circuits of transistor amplifier using h–parameter. CE, CB, CC transistor amplifier circuits, DC and AC analysis.
4. **Feedback Amplifier**
General theory of feedback, types of feedbacks, effect of negative feedback on stability, band width, noise, input resistance, output resistance. Detailed analysis of voltage series, voltage series amplifier, current series amplifier, emitter follower.
5. **Oscillators**
RC phase shift, Weinbridge, Hartley Colpitts and Crystal oscillator.
6. **Field Effect Transistor**
Junction field effect transistor, V–I characteristics, different configuration of JFET, different parameter of JFET, common source configuration as an amplifier, MOSFET and its classification.
7. **Low and High Frequency Response of Common Source Amplifier**
Low and high frequency FET model.

Reference :

1. Electronics devices & Circuits (*Bell David A.*) Oxford University Press – New Delhi, 2008 (5th Edition).
2. Electronics Devices & Circuits (*Boylested Robert L., Nashelsky Louis*) Pearson Education.
3. Electronics Devices & Circuits (*Millman, Halkias*) Tata McGraw Hill, New Delhi.
4. Electronics Devices & Circuits (*Boghart*) PHI, 1995.
5. Electronics Circuits Analyzer & Design (*Neamen Donald A.*) Tata McGraw Hill (2nd Edition).
6. Semiconductor Data Manual, BPB Publications.



Engineering Mathematics – III [EM-III]
S.E. Sem. III [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	–

SYLLABUS

1. Laplace Transform

Functions of bounded variations.

Laplace Transforms of $1, t^n, e^{at}, \sin at, \cos at, \sinh at, \cosh at, \operatorname{erf}(t)$ Linear property of L.T. First

shifting theorem Second shifting theorem $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n}{dt^n} f(t)\right\}$. Change

of scale property of L.T. Unit step function. Heavyside, Dirac delta functions, Periodic functions and their Laplace Transforms.

(a) Inverse Laplace Transforms : Evaluation of inverse L.T., partial fractions method, convolution theorem.

(b) Applications to solve initial and boundary value problems involving ordinary diff. Equation with one dependant variable.

2. Complex Variables :

Functions of complex variables, continuity and derivability of a function, analytic functions, necessary condition for $f(z)$ to be analytic, sufficient condition (without proof), Cauchy – Riemann conditions in polar forms. Analytical and Milne – Thomson method to find analytic functions $f(z) = u + iv$ where (i) u is given (ii) v is given (iii) $u+v$ (iv) $u-v$ is given. Harmonic functions and orthogonal trajectories.

(a) Mapping : Conformal mapping, Bilinear mapping, fixed points and standard transformation, inversion, reflection, rotation and magnification.

(b) Line Integral of function of complex variable, Cauchy’s theorem for analytical function (with proof), Cauchy’s Goursat theorem (without proof), properties of line integral, Cauchy’s Integral formula and deduction.

(c) Singularities and poles: Taylor’s and Laurent’s development (without proof), residue at isolated singularity and it’s evaluation.

(d) Residue theorem application to evaluate real integrals of type

$$\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta \quad \text{and} \quad \int_{-\infty}^{+\infty} f(x) dx$$

3. Fourier series :

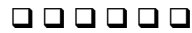
Orthogonality and orthogonal functions, Expression for the function in a series of orthogonal functions. Dirichlet’s conditions, Fourier series of periodic functions with period 2π or 2ℓ . (Derivation of Fourier coefficients a_0, a_n, b_n is not expected) Dirichlet’s theorem Even and Odd functions. Half range sine and cosine expressions Parsaval’s identities (without proof).

(a) Complex form of Fourier Series :

Fourier transform and Fourier integral in detail.

Reference :

1. Textbook of Applied Mathematics (*Wartikar P.N., Wartikar J.N.*) Pune Vidyarthi Griha Prakashan, 1981.
2. Advanced Engineering Mathematics (*Kreyszig Erwin*) Wiley Student Edition – New Delhi, 2006 (8th Edition).
3. Complex Variables (*Churchil*) McGraw Hill.
4. Theory of Function Complex Variable (*Shantinakaran*) S. Chand & Co.
5. Engineering Mathematics (*Shastri S.S.*) Prentice Hall.
6. Advanced Modern Engineering Mathematics (*Glyn James*) Pearson Education Ltd., 2004 (3rd Edition)



Electrical Networks [EN]

S.E. Sem. III [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical and Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Networks Theorems

Analysis of networks with dependent and independent sources, mesh analysis, nodal analysis, source transformation technique, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, solution of networks with AC sources. Analysis of coupled circuits (self inductance, mutual inductance, and dot convention)

2. Graph Theory

Introductory definition – Graph of a network, trees, co-trees, loops, Incidence matrix, loop matrix and cutset matrix. Network equilibrium equations, Duality.

3. Time and Frequency response of circuits

Voltage/current relations for R, L, C and their equations in time domain. Initial and final conditions, first and second order differential equations, steady state and transient response. Analysis of transient and steady state responses using Classical technique as well as by Laplace transforms. Steady state response to step, ramp, impulse and sinusoidal input functions.

4. Network Functions and Two-Port Network

Network functions – driving point and transfer functions. Poles and zeros, time domain behavior from pole zero plot. Concept of two port network. Open circuit impedance (Z) parameters, short circuit admittance (Y) parameters, transmission (ABCD) parameters, inverse transmission parameters, hybrid parameters. Interrelation of different parameters, Interconnection of two port networks, T and π representation. Terminated two-port networks.

5. Fundamentals of Network Synthesis.

Casuality and stability, Hurwitz polynomials, positive real functions, synthesis of one port networks with two kinds of elements. Properties and synthesis of L-C, R-C, R-L driving point impedances, synthesis of R-L-C functions.

Properties of transfer functions, zeros of transmission, synthesis of Y_{21} and Z_{21} with a 1-Ohm termination, synthesis of constant – resistance networks.

Reference :

1. Network analysis & synthesis (Kuo Franklin F.) Wiley Eastern Ltd., 1991.
2. Network analysis (Van Valkenburg M.E.) Eastern Economy Edition, 1983, (3rd Edition).
3. Network & systems (roy Chaudhary D.) Wiley Eastern Ltd., 1991.
4. Engineering Circuit Analysis (Hayt William, Kemmerly Jr. Jack E.) Tata McGraw Hill – New Delhi, 2002 (6th Edition).
5. Electric Circuits (Edminister Joseph A., Nahvi Mohmood) Tata McGraw Hill – New Delhi, 1999 (3rd Ed.).
6. Circuits & Networks Analysis & Synthesis (Shyammohan Sudhakar) Tata McGraw Hill, 2000 (13th Ed.).
7. Circuits (Bruce Carsion A.) Brooks/Cole Thomson Learning, 2009.
8. Linear Circuits Analysis (Dav Artice M.) PWS Publishing Co., 1998.
9. Fundamentals of Electric Circuits (Alexander Charlesk, Mathew N.O., Sadlku) McGraw Hill, 2000.



Digital Electronics [DE]

S.E. Sem. III [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	2 Hrs.	50
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Introduction

Number systems, binary, octal, hexadecimal and others. Conversion from one system to another. Arithmetic, binary BCD and hexadecimal.

2. Binary codes

Weighted, reflective, sequential, gray, error detecting codes, odd, even parity, hamming codes, alphanumeric, Morse teletypewriter ASCII, EBCDIC codes, converting binary to gray and gray to binary and XS3.

3. Boolean Algebra Logic Gates

AND, OR, NOT, XOR, XNOR, operations NAND, NOR use of universal gates for performing different operations. Laws of Boolean Algebra, De–Morgan’s theorems. Relating a truth table to a Boolean expression. Multi level circuit.

4. Combinational Circuits

K–Maps and their use in simplifying Boolean expressions, minterm, maxterm SOP and POS implementation. Implementing a logic function using universal gates. Variable entered maps for five and six variable functions: Quine McClusky tabular techniques.

5. Combination Logic Circuit Design

Designing code converter circuits e.g. binary to gray, BCD to seven segment parity generator. Binary arithmetic circuits:– Adders, subtractors (half and full), BCD adder–subtractor, carry look head adder, serial adder, multiplier magnitude comparator, arithmetic logic units.

6. Use of Multiplexers in logic design

Multiplexer (ULM) shannon’s theorem, ULM trees, de Multiplexers, designing using ROMs and ULMs. Hazards in combinational circuits.

7. Sequential Logic Circuits

Comparison of combinational and sequential circuits, multivibrators (astable, monostable and bistable), flip–flops, SR, T, D, JK. converting one flip–flop into another, use of debounce switch, counters modulus of a counter, ripple counters, up/down counter, designing sequential counters using gate IC and counter by drawing state transition diagram and state transition table. Ring counter, Johnson counter, twisted ring counter, pseudo random number generator, unused states and locked conditions.

8. Registers

Serial input serial output serial input parallel output, left shift, right shift register, use of register ICs for sequence generator and counters.

9. Memories

RAM, ROM the basic cell IC bipolar, CMOS, RAM dynamic RAM cell. Magnetic core NVRAM, bubble memory, CCD, PAL, PLA. Introduction to PLD’s.

10. Logic Families

Basics of digital integrated circuits, basic operational characteristics and parameters. TTL, schottky clamped TTL, tristate gate ECL, IIL, MOS devices CMOS comparison of logic families. PMOS and NMOS and E²CMOS. Introduction to FPGA.

Reference :

1. Modern Digital Electronics (*Jain R.P.*) Tata McGraw Hill, 1984.
2. Digital Principles and Applications (*Malvino Leach*) Tata McGraw Hill, 1991.
3. Digital Fundamentals (*Floyd Thomas L.*) Belland Howell Company, 1993.
4. Digital Design (*Morris Mano M.*) Prentice Hall International, 1984.
5. Electronic Logic Systems (*Almaini A.E.*) PHI, 1986 (2nd Edition).
6. Digital Electronics (*Malvino*) Tata McGraw Hill, 1997.
7. Digital Systems (*Tocci*) PHI, 2000.
8. Logic Circuits (*Dr. Jog Nandini K.*) Nandu Publishers and Printers Pvt. Ltd., 1998 (2nd Edition).

