GOVT. COLLEGE OF ENGINEERING,

AMRAVATI

B. Tech. (Instrumentation)

III & IV Semester

Department of Instrumentation Engineering

2010-11

GOVERNMENT COLLEGE OF ENGINNERING AMRAVATI

DEPARTMENT OF INSTRUMENTATION ENGINEERING

B.Tech. (Instrumentation Engineering)

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem III													
IN301	Engineering Mathematics III	4	1	---	5	10	15	15	60	---	---	100	5
IN302	Electronic Devices & Circuits	4	---	---	4	10	15	15	60	---	---	100	4
IN303	Signal & System	4	1	---	5	10	15	15	60	---	---	100	5
IN304	Circuit Theory	4	---	---	4	10	15	15	60	---	---	100	4
IN305	Digital Electronics	4	---	---	4	10	15	15	60	---	---	100	4
IN306	Electronic Devices & Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN307	Circuit Theory Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN308	Digital Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN309	Computational method lab -I*	---	---	2	2	---	---	---	---	50	50	100	2
Total		**20**	**2**	**8**	**30**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**
Sem IV													
IN401	Engg. Mathematics IV	4	1	---	5	10	15	15	60	---	---	100	5
IN402	Sensors& Transducer	4	---	---	4	10	15	15	60	---	---	100	4
IN403	Control System Component	4	---	---	4	10	15	15	60	---	---	100	4
IN404	Numerical Methods	4	1	---	5	10	15	15	60	---	---	100	5
IN405	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
IN406	Sensors& Transducer Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN407	Control System Component Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN408	Linear Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN409	Computational Method Lab -II**	---	---	2	2	---	---	---	---	50	50	100	2
Total		**20**	**2**	**8**	**30**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**
Sem V													
IN501	Microprocessor Based Instrumentation	4	1	---	5	10	15	15	60	---	---	100	5
IN502	Chemical & Analytical Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4

IN503	Digital Signal Processing	4	---	---	5	10	15	15	60	---	---	100	5
IN504	Electronic Instrumentation	4	1	---	4	10	15	15	60	---	---	100	4
IN505	Material Science & Process	4	---	---	4	10	15	15	60	---	---	100	4
IN506	Microprocessor Based Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN507	Chemical & Analytical Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN508	Electronic Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN509	General Proficiency-I	---	---	2	2	---	---	---	---	50	50	100	1
Total		**20**	**2**	**8**	**30**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**27**

Sem VI

IN601	Distributed Control System	4	---	---	4	10	15	15	60	---	---	100	4
IN602	Microcontroller & It's Application	4	---	---	4	10	15	15	60	---	---	100	4
IN603	Power Electronics	4	---	---	4	10	15	15	60	---	---	100	4
IN604	Power Plant Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
IN605	Feedback Control System	4	---	---	4	10	15	15	60	---	---	100	4
IN606	Distributed Control System Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN607	Microcontroller & It's Application Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN608	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN609	General Proficiency-II	---	---	2	2	---	---	---	---	50	---	50	2
IN610	Minor Project	---	---	2	2	---	---	---	---	50	---	25	2
Total		**20**	---	**10**	**30**	**50**	**75**	**75**	**300**	**175**	**75**	**750**	**27**

Sem VII

IN701	Modern Control Theory	4	---	---	4	10	15	15	60	---	---	100	4
IN702	Biomedical Instrumentation	3	---	---	4	10	15	15	60	---	---	100	4
IN703	Instrumentation System Design	4	---	---	4	10	15	15	60	---	---	100	4
IN704	Operation Research & Management	4	---	---	4	10	15	15	60	---	---	100	4
IN705	Elective-I	4	---	---	4	10	15	15	60	---	---	100	4
IN706	Biomedical Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN707	Instrumentation System Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN708#	Seminar & Project	---	---	6	6	---	---	---	---	50	100	150	5

Total		**20**	---	**10**	**30**	**5**	**75**	**75**	**300**	**100**	**150**	**750**	**27**

Sem VIII

IN801	Process Instrumentation & Control	4	---	---	4	10	15	15	60	---	---	100	4
IN802	Project Engineering & Management	4	---	---	4	10	15	15	60	---	---	100	4
IN803	Elective -II	4	1	---	5	10	15	15	60	---	---	100	5
IN804	Elective-III	4	1	---	5	10	15	15	60	---	---	100	5
IN805	Process Instrumentation & Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN806	Project Engineering & Management Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN807#	Project- II	---	---	8	8	---	---	---	---	100	150	250	7
Total		**16**	**2**	**12**	**30**	**40**	**60**	**60**	**240**	**150**	**200**	**750**	**27**

Duration of ESE is 2 Hrs 30 Minutes for all courses

TA :Teacher Assessment **CT: Class Tests** **ESE: End Sem. Examination**

 # For project there will be 4 students in each batch

*** Lab-I has programming based on basic MATLAB**
**** Lab -II has programming based on MATLAB toolbox like neural network, fuzzy logic optimization**

Electives

Elective-I (IN705)	**Elective-II (IN803)**	**Elective-III (IN804)**
A) Opto- Electronics Instrumentation	A) Advance Sensors	A) Image Processing
B) Instrumentation for agriculture & Food Processing	B) Neural Network and Fuzzy logic control	B) Adaptive Control
C) Embedded Systems	C) Computer Network	C) System Identification
D) Biomedical Signal Processing	D) Digital Control System	D) Nonlinear Control

IN301 ENGINEERING MATHEMATICS –III

Teaching Scheme : 04 L + 01 T Total 05 **Credit : 05**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2hrs 30min.

Matlab should be used for imparting instruction.

Ordinary differential equation : Complete solution, operator D, Rule for finding complementary function, Inverse operator, rules for finding particular integral, method of

variation of parameter, Cauchy's and Legendre's linear differential equations. Fundamental theorem of integral calculus, mean value theorems, evaluation of definite integrals, reduction formulae.

Laplace Transform : Definition of Laplace Transform, Linearity property, condition for

existence of Laplace Transform; First & Second Shifting properties, Laplace Transform of derivatives and integrals; Unit step functions, Dirac delta-function. Differentiation and

Integration of transforms, Convolution Theorem, Inversion. Periodic functions. Evaluation of integrals by L.T., Solution of boundary value problems. Convergence of improper integrals, tests of convergence, Beta and Gamma functions elementary properties, differentiation under integral sign, differentiation of integrals with variable limits Leibnitz rule, integrals dependent on a parameter application. Rectification, Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green. Gauss and Stokes, orthogonal curvilinear coordinates. Vector spaces Linear dependence of vectors, basis, linear transformations, Hermitian and skew Hermitian matrices.

Text Books:

1. Advanced Engineering mathematics.- Erin Kreyzig. John Wily & Sons Inc. 9th Edition.1995

2. A Text book of Applied Mathematics by P.N. Wartikar & J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune

Reference Books:

1. Advanced Engineering Mathematics by C.R.Wylie, McGraw Hill Publications
3. Elements of Applied mathematics by P.N.Wartikar & J N. Wartikar Pune Vidyarthi Griha Prakashan, 9 th Edition1960 Pune
4. Higher Engineering Mathematics by B.S. Grewal, Khanna Publication, New Delhi
5. Advanced Engineering Mathematics 5/e By Peter V.O'Neil, Thomson Book.
6. Higher Engineering Mathematics By Ramanna - Tata Mc Graw Hill
7. Advanced Engineering Mathematics by R.K.Jain ,S.R. K. Lyengar, Narosa Publication House New Delhi
8. http://www.nptel.iitm.ac.in/
9. www.ocw.mit.edu

IN 302 ELECTRONICS DEVICES & CIRCUITS

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2hrs 30min.

Semiconductor diode: P-N junction diode, V-I characteristics, rectifier circuits, filter circuits, voltage multiplier, clipping circuits, clamping circuits, peak detector, differentiator, and integrator circuits, Zener diode as a voltage regulator, tunnel diode.

Bipolar Junction Transistor: Transistor characteristics, Transistor amplifier characteristics, transistor biasing, thermal stability, thermal runway Amplifier configurations and comparison, Hybrid model h- parameters. Low frequency response of transistor amplifier, introduction to high frequency response of transistor amplifier, multistage amplifier, amplifier noise and distortion amplifier concept computation creation, two stage RC Coupled amplifier, high input resistance transistor circuit.

Large signal amplifiers: Class A, B, AB, and C operations and their performance characteristics, push pull, complimentary symmetry amplifier.

Feedback amplifiers: Feedback concept, transfer gain, general characteristics of negative feedback amplifier, methods of feedback and their effects.

Oscillators: Sinusoidal oscillator, resonant circuit, phase shift oscillator, wein bridge oscillator, crystal oscillator and frequency stability, collpitts oscillator, Hartley oscillator. Transistor switch multivibrators of different types, Schmitt trigger.

Introduction to Unipolar Devices: Ideal M/S diode, Si-SiO2 MOS diode, MOSFET, MOSFET structures, Basic device characteristics, FET, Comparison of BJT and FET amplifier.

Text Books:

1. Electronic Devices & Circuit Theory by Boylestad & Nishelsky, Prentice Hall of India 9th Edition2005

Reference Books:

1. Integrated Electronics Analog and Digital Circuits and System- Millman & Halkias, McGraw Hill 1972
2. Electronics Fundamentals – Malvino A.P.. & Leach D.P.McGraw Hill New Delhi 5th Edition 2003

IN303 SIGNALS AND SYSTEMS

Teaching Scheme : 04 L + 01 T Total 05 **Credit : 05**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs 30min.

Matlab should be used while imparting instruction.

Introduction to Signals and Systems: Signals and Systems, Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Time Domain and Frequency Domain, Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems Fourier series and Its Properties Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

Sampling: Representation of a continuous–Time Signal by its Samples; The Sampling Theorem; Reconstruction of Signals from its Samples using Interpolation; Effect of

Under Sampling (Frequency Domain Aliasing); Discrete Time processing of Continuous–Time Signals.

The Z Transform: The Z Transform; the Region of Convergence for the Z Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Z-Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform; System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z-Transform.

Discrete Fourier Transform and Fast Fourier Transform: Representation of Discrete-Time a periodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

Text Books:

1. Signals And Systems by Haykin S., 2nd Edition, John Wiley And Sons 1999

Reference Books:

1. Analog And Digital Signal Processing by Ambardar A, 2/3; Thomson Learning, 2nd Edition 2002
2. Signals and systems" by Oppenheim and Shapher Prentice Hall India of India 2nd Edition 1997
3. Signal & System: Analysis using , Transform Method and Matlab by Roberts M.J. McGraw Hill company Ltd 2nd Edition 2003

IN304 CIRCUIT THEORY

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2hrs 30min.

Terminal Element Relationships: V-I relationship for Inductance and Capacitance-Constant Flux Linkage Theorem and Constant Charge Theorem - V-I relationship for dependent voltage and current sources, Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.

Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal Vs mesh analysis, computer aided circuit analysis using Pspice.

Useful circuit analysis techniques: Linearity and superposition, source transformations, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Delta-Wye transformations.

Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of DC steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution, Solution of two mesh circuits by differential equation method-Determination of initial conditions. Time domain analysis using Pspice.

Review of Laplace Transforms: Laplace Transform-Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms-Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. (Review to be done by students. No class hour will be spent for this review.)

Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros, Pole Zero plots, using Pspice for transform domain analysis.

Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasors, relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors, Pspice for sinusoidal steady state analysis.

Fourier Series: Fourier Series representation of non-sinusoidal periodic waveforms - Fourier Coefficients, Determination of Coefficients, Waveform Symmetry-Exponential Fourier Series-Discrete Amplitude and Phase Spectra-Steady State Solution of Circuits with non-sinusoidal periodic inputs by Fourier Series

Two Port Networks: Two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-

Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network Functions-Pole Zero plots and steady state response from pole-zero plots. Use of Pspice for two port networks.

Textbooks:

1. Engineering Circuit Analysis by Hayt & Kemmerly, Tata McGraw Hill, 7th Edition 2007
2. Network Analysis, by Van Valkenberg M.E., Prentice Hall India New Delhi 1996 3rd Edition

Reference Books:

1. Electric Circuits, by Edminister J.A. : Schaum's Outline Series, McGraw-hill 2nd Edition 1988
2. Basic Circuit Theory by Huelsman L.P. Prentice Hall India New Delhi 3rd Edition 2002

IN 305 DIGITAL ELECTRONICS

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE: 2hrs 30min.

Number system: Binary, octal, hexadecimal, BCD codes, Gray codes. Arithmetic operations: Addition, Subtraction, multiplication, division in Binary, octal and hexadecimal.

Combination logic: Switching algebra, combinational circuit analysis, combinational circuit synthesis, and combinational circuit minimization, K-Map of three, four, five variable functions, minimizing SOP and POS expressions. Quine McClusky minimization, other minimization methods, timing hazards, designing hazard free circuits, circuit timing, design of encoders, decoders, tri-state devices, multiplexers, demultiplexers, comparators, arithmetic circuits– half and full adders, ripple adders, sub tractors, carry look ahead adders, combinational multipliers, examples- barrel shifter, floating point encoder etc.

Sequential logic design: Latches and flip flops, edge triggered and master slave flip flops (SR, JK, D, T etc), feedback sequential circuit design, sequential PLDs, Counters

and shift registers, synchronous design methodology, clock skew, gating the clock, asynchronous inputs.

A/D Converters: Single slope, dual slope tracking and successive approximation type, introduction to flash A/D converter, comparison of commercial IC's and Criteria for judging the performance.

D/A converters: Binary weighted resister type, R-2 R ladder type.

Memories: ROM, PROM, EPROM, EEPROM, R/W memory, static and dynamic, magnetic bubble memories, magnetic type recording, recording modes, floppy disks and hard disks, description of standard memory IC's.

Logic families: DTL, RTL, ECL, IIL, TTL, MOS/ CMOS, comparison of TTL & CMOS characteristics, interfacing techniques. Display LED/LCD, interfacing.

Text Books:

1. Modern Digital electronics by Jain R.P., Tata McGraw Hill Edition, 6th Edition2006

Reference Books:

1. Digital Principles & Applications:. Malvino A.P, Leach D.R. , Tata McGraw Hill
2. Digital Design – Morris M., Mano, Tata McGraw Hill.4th edition,2006.
3. An Engineering Approach to Digital Design,. Fletcher W. I ,Prentice Hall of India, New Delhi.1997
4. Digital design- Principles and Practices, Wakerly J. F. , P H International /Pearson India, 4th edition 2005
5. Digital Circuits and Logic Design, Samuel C. Lee, Prentice Hall of India, New Delhi.1976

IN 306 ELECTRONICS DEVICES & CIRCUITS LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN302 Electronic Devices & Circuit

Representative list is as follows.

1. Study of constructional features and package styles of electronic components viz. resistors, capacitors, transistors, diodes, IC's etc.
2. V-I characteristics of P-N junction diode and Zener diode.
3. Determination of performance of half wave, center tap full wave bridge rectifier circuit using semiconductor diodes.
4. Input and output characteristics of transistor in CB and CE configuration.
5. Calculation of H parameters for a CE amplifier.
6. Design and construction of R-C phase shift oscillator.
7. Drain characteristics of FET.
8. Performance of transistor series regulator.
9. Performance measures of Zener shunts regulator.
10. Testing of Hartley / Colpitts oscillator.
11. Assmbly study and testing of RC coupled amp. (Freq. response)
12. Determination frequency response of transformer coupled amplifier.
13. Design and testing of crystal oscillator.
14. Design of emitter follower amplifier.
15. Soldering and disordering of electronic components and design, assembly of simple transistor amplifier and testing for gain, frequency response.

Note: Verify all above Practical's using Electronics component simulator software

IN307 CIRCUIT THEORY LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN304 Circuit Theory.

Representative list is as follows.

1. Kirchhoff's law justification.
2. Maximum power transfer theorem practical justification.
3. Thevenin's theorem practical justification.
4. Norton's theorem practical justification.
5. Plotting of behavior of RC circuit for step input.
6. Plotting of behavior of RL circuit for step input.
7. Plotting of behavior of RLC circuit for step input.
8. Plotting of behavior of RLC circuits for ramp input.
9. Fourier series analysis of square wave.

10. Fourier series analysis of triangular wave.
11. To determine the hybrid and impedance parameters of a given network.
12. To determine frequency response of lo pass, Hi pass, band pass RLC filter.

IN 308 DIGITAL ELECTRONICS LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN305 Digital Electronics.

Representative list is as follows.

1. Performance of logic gates.
2. Performance NAND / NOR gate as universal gate.
3. Design and performance Half /Full adder subtractor.
4. Design & performance of Code converter.
5. Design and performance of Multiplexer / demultiplexer.
6. Flip-flops design
7. Shift registers design.
8. Dawn counter design.
9. A/D Converter design and testing.
10. D /A converter design and testing.
11. Asynchronous decade counter design.
12. Performance of RAM and EPROM.
13. Performance of LED / LCD display.
14. Performance of RAM and EPROM.

IN 309 COMPUTATIONAL METHOD LAB-I

Teaching Scheme : 02 P Total 02 **Credit : 02**

Evaluation Scheme : 50 Internal + 50 External **Total Marks: 100**

Minimum Eight Program to be performed covering the entire syllabus of IN309 Computational Method Lab.

Introduction to MATLAB – The MATLAB environment, the command window, edit window, advantages of MATLAB, workspace, getting help.

MATLAB Basics – Variables and arrays, initializing variables in MATLAB, subarrays, special values, displaying output data, data files, scalar and array operations, hierarchy of operations, built in MATLAB functions, introduction to plotting, simple plots, multiple plots, and logarithmic scales.

Programming in MATLAB – Good programming practices, relational and logical operators, branches, additional, plotting features, loops, while and for loops, programming examples.

User defined functions - Introduction to MATLAB functions, variables passing in MATLAB, optional arguments, sharing data using global memory, preserving data between calls to a function, function functions, sub functions and private functions, input/output functions.

Advanced topics – Brief introduction to GUIs, Handle graphics, designing a simple GUI.

Text Book

1. MATLAB programming for Engineers Stephan J Chapman. Pearson Education second Edition 2004.

IN401 ENGINEERING MATHEMATICS –IV

Teaching Scheme : 04 L + 01 T Total 05 **Credit: 05**

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE : 2hrs 30min.

Matlab should be used for imparting instruction

Limit-continuity: Differentiability and analyticity of functions Cauchy-Riemann equations, Elementary complex functions, Line integrals, Cauchy's integral theorem, Cauchy's integral formula, Power series, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem.

Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes_ Theorem, and independence .

Random Variables: Discrete, continuous and mixed random variables, probability mass,

probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev's Inequality.

Special Distributions: Discrete uniform, Binomial, Geometric, Poisson, Exponential, Gamma, Normal distributions, Function of a Random Variable.

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation, independence of random variables, bivariate normal distribution.

Text Books:

1. Fundamental of Statistics by S.C. Gupta Himalaya Publication 1984

Reference Books:

1. Higher Engineering Mathematics by B.S. Grewal, 6th Edition, Khanna Publication, New Delhi 1976
2. http://www.nptel.iitm.ac.in/
3. www.ocw.mit.edu

IN402 SENSORS AND TRANSDUCERS

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE : 2hrs 30min.

Definition& Concept: Transducer, Sensor, Calibration, Range and Span. Classification: Active, passive, primary, secondary, mechanical, electrical, electronic, analog and digital transducers. Selection criteria, sources of errors and their types, Static and Dynamic characteristics.

Displacement: (Working principles, types, measuring circuits and applications) Resistive: Potentiometers, strain gauges. Inductive: LVDT,RVDT and Eddy current type Transducers. Magnetic pickups. Capacitive: Capacitance pickups, Differential capacitive cells. Piezoelectric, Ultrasonic transducers and Hall effect transducers Optical transducers, Encoders, Photoelectric pickups, stroboscopes.

Vibration and acceleration: Eddy current type, piezoelectric type, Seismic type. Jerk meter. Force and weight: Basic methods of force measurement, elastic force traducers,

strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, Torque: Strain gages, feedback torque sensors, torsion bar dynamometer, etc. Shaft power: Dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement.

Temperature: Temperature scales, Classification of temp. Sensors.
Thermometers: Bimetallic strip, metal expansion type, mercury in glass, liquid thermometer, Thermostat. RTD: Types- PT100, 2 wire RTD, Bare and Industrial RTD, Lead wire compensation. Self heating effect.
Thermistors: Types: NTC, PTC
Thermocouples: Terminology, types (J, K, E, R, S, T) and characteristics, law of thermoelectricity, thermocouple tables, cold junction compensation methods, change of table reference construction and protection, thermo well, thermopile.
Semiconductor temperature sensors: Diode and IC temp sensors. Ultrasonic temp detector, quartz crystal temperature detector.
Radiation: Pyrometers (Total and Radiation), Infrared sensors. Fiber optic thermometer**.**

Flow: Bernoulli's theorem, Reynolds Number. Differential pressure type flow sensors: Orifice and their types, Venturi and Nozzle. Pressure taps Pitot tube, annu bar. Variable area meter (Rotameter). Turbine type flow meter, Electromagnetic flow type, ultrasonic flow meter, Vortex shedding type, mass flow meters, anemometers, flow tantalizers and solid flow measurement.

Pressure: Pressure scale, Manometers: U-tube, well type, inclined tube, ring balance and digital manometer. Elastic pressure sensors: Bellows, bourdon tubes, diaphragm, (types, materials, range, sensitivity, construction, resonant frequency, advantages and limitations). Secondary pressure sensors. Differential pressure measurements: Force balance type, motion balance type, capacitive (delta cell), ring balance, vibrating cylinder type. High-pressure sensors: Dead weight tester, Bulk modulus cell, Bridge man type (Pressure sensitive wires).Vacuum sensors: McLeod gauge, thermal conductivity (Pirani, Thermocouple gage) ionization types,

Level: Float displacers, bubbler, and DP- cell Ultrasonic, capacitive, radar, resistance, Solid level detectors, and fiber optic level detectors.

Miscellaneous Measurements: pH, Conductivity, Humidity, moisture & sound measurement

Text Books:

1. Electrical ,Electronic Instrumentation & Measurement - Sawhney A. K., Dhanapat Rai & Sons.1995

2. Instrumentation Devices and systems – Rangan , Mani , Sharma. Tata McGraw Hill, Delhi, 1997

Reference Books:

1. Principle of industrial Instrumentation – Patranabis D. Tata McGraw Hill, Delhi.,1997
2. Instrumentation and Measurement Principles –. Murthi D.V.S , Prentice Hall of India. New Delhi,1995
3. Instrumentation Measurements and Analysis –Nakra B.C.and Choudhari K.K., Tata McGraw Hill Co Ltd. New Delhi.2001

IN403 CONTROL SYSTEM COMPONENTS

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE : 2hrs 30min.

Non-Electrical system components:

Mechanical networks and Gears: Introduction, springs, mass dash-pot and absorbers, mechanical equalizes and their transfer function, comparison of electrical and mechanical systems, introductions to gears, types of gears and use of gears in control system. **Mechanical components:** flyweight tachometer, gyroscope, and principal of its operations, equation of motion of gyroscope practical gyroscope, application of yroscope.

Hydraulic components: introduction to basic types of hydraulic transmission lines, servo motors, power supply, Hydraulic circuits and transmission, applications like motor speed control, reciprocating, loading, unloading, sequencing of cylinders and direction control.

Pneumatic components: Pneumatic power supplies, introduction to pneumatic systems and their analysis, filters and pressure regulators, flapper nozzle system, pneumatic motors. Pneumatic Power Cylinder.

Control valves: Classification & Types of valves. Valve actuators and accessories, detail study of valve characteristics. Study of valve construction by considering examples from hydraulic, pneumatic and electrical types. Introduction to valve selection and

specifications. Valve sizing with mathematical treatment. Introduction to analog and digital fluidic devices.

Electrical System Components:

Synchros: transmitter and receiver construction, principal, analysis and applications of Synchros as an error detector.

AC and DC servomotors: Constructional features, theory of operations, analysis, and approximate transfer function and block diagram, load-torque, speed-torque characteristics, electronic drive circuits, comparative studies and applications in control system.

Stepper motor: construction, types such as variable reluctance stepper motor, single stack and multi stack, permanent magnet stepper motor, hybrid steeper motors and their principle of operations, drive circuits and high speed operations, applications in control systems.

Relays ON/OFF Valves, Solenoid Valves.

Text Books:

1. Control system components- Gibson John E. & Tuteur Franz B. , McGraw Hill Book, New York 1958

Reference Books:

1. Control System Engineering by Nagrath I. J. , M. Gopal John Wiley & Sons 2nd edition 1982 Delhi
2. Valve Handbook by Philip L. Skousen The McGraw –Hill 2004
3. Industrial control Handbook- E.A. Parr. Industrial Press Incc. Third Edition 1999
4. Control system Components Shamray B.V. Asia Publication Bombay 1967

IN404 NUMERICAL METHODS

Teaching Scheme : 04 L + 01 T Total 05 **Credit : 05**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs 30min.

Matlab should be used while imparting instruction.

Computer Arithmetic: Floating Point representation, Arithmetic operations with normalized floating point numbers, errors in numbers, Truncation error, round off error, inherent error, absolute and relative error.

Solution of Non linear Equations: Bisection method, false position method, Newton-Raphson method, Method of successive approximation, rate of convergence.

Interpolation: Lagrange's interpolation, difference table, Newton's Interpolation, iterated linear interpolation technique.

Solution of simultaneous algebraic equations: Gauss elimination method, Iterative methods and their convergence. III conditions equation, Gauass seidal method.

Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Romberg integration, Newton's cote's integration formula, error in these formulae.

Solution of Ordinary differential equation: Taylor series method, Picard's method, Euler method, Range-Kutta method second and fourth order, predictor corrector method.

Numerical solution of partial differential equation: Finite difference, approximation to derivatives. Laplace equation, Iterative methods for the solution of equations.

Least square approximation of functions: Linear regression, Polynomial regression, fitting exponential and trigonometric functions.

Linear Programming: Introduction, General linear programming problem, graphical method, canonical & standard form of L.P.F., simplex method, Duality concept.

Text Books:

1. Numerical methods for Engineers, by Steven C. Chapra and Raymond P. Canal Tata McGraw-Hill 2005

Reference Books:

1. Computer Oriented Numerical Method by V. Rajaraman - Prentice Hall of India.2004
2. Numerical Methods with FORTRAN IV case studies, William S. Dorn & Daniel D. Mccracken Willeginkerna
3. Numerical Methods in Engineering & Science by B.S. Grewal- Khanna Publishers.
4. Introductory methods of numerical analysis by S.S. Shastry- Prentice Hall of India 2004

IN 405 LINEAR INTEGRATED CIRCUITS

Teaching Scheme : 04 L Total 04 **Credit : 04**

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE : 2hrs 30min.

Integrated circuits: An over view of IC design technology, introduction to water cleaning, photolithography, Ion implantation. Classification of IC families and their comparison. Study of data sheets of 741, 301, OP-07 and 324. Op-amp ideal characteristics and op-amp parameters.

OP-amp with positive and negative feedback: Inverting, Non-inverting and differential amplifier configuration and their special cases. Summing, scaling, averaging, instrumentation amplifier, integrator and differentiator, V to I and I to V converters.

Active filters and oscillators: Frequency response of op-amp, low pass, high pass first and second order, band pass, band reject and all pass Butterworth filters. Introduction of Chebyshev filters, multivibrators. Introduction to Oscillator using op-amps such as phase shift oscillator, Wein bridge oscillator, square wave, triangular wave and saw tooth wave generators.

Comparators and Converters: Basic comparators, zero crossing detectors, Schmitt trigger, voltage limiters, V/F and F/V converters(IC 9400), clippers and clampers, absolute value o/p circuit, sample and hold circuit.

Study of some important IC's: The 555 timer and its applications, the 723 and 78xx and 79xx voltage regulator IC's. The PLL IC's 565 and its applications. The VI7660 voltage inverter and its applications.

Analog computation and simulation: Introduction to analysis of linear differential equations, time and magnitude scaling. Applications to transfer function simulations.

Text Books:

1. Op-amp and Integrated Ckt by -- Ramakant A. Gaikwad, Prentice Hall of India Latest Edition 4th edition 1999

Reference Books:

1. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco. McGraw Hill 3rd 1998 Edition,New Delhi.
2. Operational Amplifier & Linear Integrated circuit by Robert F. Coughlin and Frederick F. Driscoll Pearsons 2003
3. Integrated circuit by K.R. Botkar, Khanna Publication, New Delhi 1990
4. Analog Computation and Simulations, V. Rajaraman, Prentice Hall of India, New Delhi.1971

IN406-SENSOR AND TRANSDUCER LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN402

Sensors & Transducer

Representative list is as follows.

1. Calibration of Displacement measurement system. (Strain Gauges and LVDT).
2. Calibration of Speed measurement system. (Photoelectric and Tachometer).
3. Calibration of Temperature measurement system. (Thermocouple and RTD).
4. Calibration of Flow measurement system. (Orifice, Venturi and Rotameter).
5. Calibration of Pressure Gauges using Dead Weight Tester.
6. Differential pressure measurement using manometer/differential pressure transmitter.
7. Pressure measurement using bourdon tube/bellows/diaphragm/strain gauge.
8. Calibration of Level measurement system. (Capacitive, Bubbler Methods)

IN407 CONTROL SYSTEM COMPONENTS LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN403 Control system component

Representative list is as follows.

1. Study of syncro characteristics:
    a) Study of syncro transmitter characteristics.
    b) Study of syncro transmitter and receiver pair.
2. Study of stepper motor:
    a) Study of stepper motor and translator.
    b) Open loop control system with digital input.
    c) Open loop control system with analog input.
3. Study of a. c. servo motor:
    a) Control characteristics of servo motor by amplitude control (control voltage vs. speed characteristics)

    b) Speed torque characteristics.
4. Study of Power Cylinder.
5. Study of hydraulic control valve.
6. Study of pneumatic control valves.
7. Study of Filter & Pressure Regulator
8. Study of flapper nozzle system.
9. Study of different Hydraulic Components
10. Study of Pneumatic Components

IN408 LINEAR INTEGRATED CIRCUITS LAB

Teaching Scheme : 02 P Total 02 **Credit : 01**

Evaluation Scheme : 25 Internal + 25 External **Total Marks: 50**

Minimum Eight Experiments to be performed covering the Entire Syllabus of IN405

Linear Integrated Circuit

Representative list is as follows.

1. Measurement of op-amp parameters and comparison with op-amp data sheets.
2. Assembling of op-amp Inverting, Noninverting and differential ckts to measure an input in the range of mill volts to few volts.
3. Design and signal conditioning ckts using RTD and thermister with an instrumentation amplifier to read a temperature of water bath and calibration.
4. Design of signal conditioning ckt to operate a relay or to generate timing delays (e.g.10 sec., or 20 or 20 sec. or 1 minute) using IC 555.
5. Design of a ckt to work as a current source using IC 78xx.
6. Design of a ckt to work as voltage regulator of 10 or 20 volts using IC 723.

7. Precision rectifier to rectify few volts as input.
8. Use of 565 PLL as a frequency multiplier.
9. Design of Oscillators using op-amp. and testing.
10. Design of single stage differential amplifier and testing.
11. Design of low and high pass filters with a cut off frequency of 1 kHz or 2 kHz and testing for frequency response.
12. Design of instrumentation amplifier using 3 op-amps and testing for gain, frequency response.
13. Design of cascade amplifier system using op-amp and testing for gain and frequency response.
14. Design of attenuator circuit using amplifier and testing for gain.
15. Testing of faulty analog instrument and finding faults.
16. Design of band pass filter using op-amp and testing for frequency response.

IN409 COMPUTATIONAL METHOD LAB- II

Teaching Scheme : 02 P Total 02 **Credit : 02**

Evaluation Scheme : 50 Internal + 50 External **Total Marks: 100**

Minimum Eight Program to be performed covering the Entire Syllabus of IN409 Computational Method Lab-II.

The students are expected to use Matlab for following topics

1. Ordinary linear constant coefficient differential equations.
2. Graphical solution of differential equations
3. Matrix and linear algebra problems
4. Solution of system of linear equations with Matlab
5. Laplace transform and Fourier analysis
6. Partial differential equations
7. Probability and statistics
8. Detailed study of symbolic Math toolbox
9. Detailed study of Signal processing toolbox