EE 385

TRANSDUCERS LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Measurement of speed by magnetic pickup
2. Measurement of temperature by (a) Thermistors (b) Thermocouple
3. Study and calibration of strain gauge
4. Measurement of speed and torque using Opto Electronic Sensor
5. Measurement of pressure by bellows
6. Measurement of Displacement by Capacitive pickup
7. Measurement of Displacement by (a) Piezoelectric pickup and (b Light dependent resistor
8. Level Measuring System
9. Study and Calibration of LVDT
10. Study and calibration of RTD
11. Measurement of displacement by inductive pickup

Note : Atleast 10 experiments should be conducted in the semester

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IIIrd YEAR
(INSTRUMENTATION ENGINEERING)

SEMESTER - II

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration In Hours	Maximum Marks	
			L	D/P		Univ. Exam	Sessionals
		THEORY					
1.	EE 350	Digital Signal Processing & Applications	4	-	3	75	25
2.	EE 354	Microprocessor and Microcontrollers	4	-	3	75	25
3.	EE 356	Power Plant Instrumentation	4	-	3	75	25
4.	EE 357	Process Control	4	-	3	75	25
5.	EE 358	Biomedical Instrumentation	4	-	3	75	25
6.	CM 371	Managerial Economics and Accountancy	4	-	3	75	25
		PRACTICALS					
1.	EE 382	Power Electronics Lab	-	3	3	50	25
2.	EE 332	Control System Lab.	-	3	3	50	25
3.	EE 384	Industrial Visit	-	-	-	-	*Gr
		Total	**24**	**6**	**24**	**550**	**200**

****Excellent / Very Good / Good / Satisfactory / Unsatisfactory***

EE 350

DIGITAL SIGNAL PROCESSING & APPLICATIONS

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Digital Signals processing and review of Z-Transform: Classification of signals & System. Linear shifts invariant systems, stability and causality, sampling of continuous signals – Signal reconstruction, quantizing & encoding, linear constant co-efficient difference equations. Frequency domain representation of discrete time system, Application of DSP.

UNIT-II

Fourier Analysis: Discrete Time Fourier transform, Discrete Fourier series, phase and amplitude spectra, properties of Discrete Fourier transform, Linear convolution of sequence using DFT, computation of DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT.

UNIT-III

IIR Filter: Design of Butterworth and Chebyshev filters, IIR Filter design by impulse invariant transformation, bilinear transformation Realization of filter Technique, step invariance method.

UNIT-IV

FIR Filters: Characteristics of FIR Digitals Filters. Frequency response, comparison of FIR, IIR filters- Window techniques, Design of these filters using – Rectangular, Hamming, Bartlet, Kaiser windows,

UNIT-V

DSP Processors : Computer architectures for signal processing – Harvard architecture and pipelining, General purpose digital signal processors, Selection of DSPs, Implementation of DSP algorithms on a general purpose

DSP, Special purpose hardware – hardware digital filters and hardware FFT processors.

Suggested Reading :

1. P. Venkata Ramani and M. Bhaskar, *"Digital Signal Processor, Architecture, Programming & Application "* Tata MC Graw Hill-2004.
2. Avatar Singh, S.Srinivasan, *"Digital Signal Processing"*, Thomson Publication, 2004.
3. Lafley, *"DSP Processing, Fundamentals, Architecture & Features"*, S. Chand, Publishers & Co.2000
4. Oppeheium AV and Schafer R.W, *"Digital Signal Processing"*, Prentice Hall Inc. 1975.
5. Proakis, J.G., & Manolakis, D.G., *"Digital Signal Processing: Principles, Algorithms, & Applications"*, 3/e Prentice Hall of India, 1996.
6. Ifeachor, E.C., & Jervis, B.W., *"Digital Signal Processing: A Practical Approach"*, 2/e, Pearson Education Asia, 2002.
7. Mitra, S.K, *"Digital Signal Processing: A Computer-Based Approach"*, McGraw Hill, NY, 1998 (A low-cost Indian reprint is available).

EE 354

MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE & IE)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Microprocessor Architecture of 8086- Segmented memory, Addressing modes, Instruction set, Minimum and maximum mode operations.

UNIT-II

Assembly language programming, Assembler directive, simple programs using Assembler, stings, procedures, Macros, Timing.

UNIT-III

Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI) , Programmable interval Timer(8253), Keyboard and display interface, interrupts of 8086.

UNIT-IV

Microcontrollers-8051 microcontrollers, Architecture, I/O ports, Connecting external memory, Instruction set, Assembly language programming.

UNIT-V

Interrupts, serial I/O, Timers, Counters, Applications of microcontrollers-interfacing LEDs, Seven Segment display, keyboard interfacing.

Suggested Reading:

1. Douglas. V. Hall - *Microprocessors and Interfacing* - Tata McGraw Hill- Revised 2nd edition, 2006
2. Krishna Kant – *"Microprocessors and Microcontrollers- Architecture, programming and system design 8085, 8086, 8051, 8096"*, Prentice-Hall india-2007
3. Kenneth. J. Ayala – *"The 8051 Microcontrollers Architecture, programming and Applications"*, Thomson publishers, 2nd edition.
4. Walter A. Triebel & Avtar Singh- *The 8088 & 8086 Microprocessor*- Fourth edition, Pearson.
5. Myke Predko, *"Programming and Customizing the 8051 micro controller"*, Tata-McGraw Hill, 3rd reprint 2002.

EE 356

POWER PLANT INSTRUMENTATION

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Overview of Generation System: Brief survey of methods of power generation-hydro, thermal, nuclear, solar and wind power – Introduction to thermal power plant processes – building blocks - ideal steam cycles – Boiler – types, Boiler - turbine units and its range systems, feed water systems, steam circuits, combustion process, products of combustion process, fuel systems, treatment of flue gases, steam turbine, condensate systems, alternator, feed water conditioning, turbine bypass valves. Importance of instrumentation in power generation – details of boiler processes, P & I diagram of boiler – combined cycle power plant, power generation and distribution.

UNIT-II

Measurement in boiler and turbine: Metal temperature measurement in boilers, piping system for pressure measuring devices, smoke and dust monitor, flame monitoring. Introduction to turbine supervising system, pedestal vibration, shaft vibration, eccentricity measurement. Installation of non-contracting transducers for speed measurement, rotor and casing movement and expansion measurement.

UNIT-III

Controls in boiler: Problems associated with control of multiple pulverizer. Draught plant: Introduction, natural draught, forced draught, induced draught, power requirements for draught systems. Fan drives and control, control of air flow. Combustion control: Fuel/Air ratio, oxygen, CO and CO_2 trimming, combustion efficiency, excess air, parallel and cross limited combustion control, control of large systems. Boiler drum level measurement methods, feed water control, soot-blowing operation, steam

temperature control, Coordinated control, boiler following mode operation, turbine following mode operation, sliding pressure mode operation, selection between boiler and turbine following modes. Distributed control system in power plants-interlocks in boiler operation.

UNIT-IV

Turbine Monitoring and Control: Condenser vacuum control, Gland steam exhaust pressure control, Speed, Vibration, Shell temperature monitoring, Lubricating oil temperature control, Hydrogen generator cooling system.

UNIT-V

Nuclear power plant instrumentation: Piping and instrumentation diagram of different types of nuclear power plant, Nuclear reactor control loops, reactor dynamics, excess reactivity, pulse channel and logarithmic instrumentation, control and safety instrumentation, reliability aspects.

Suggested Reading:

1. C.L. Wadhwa, *Electric power systems,* Wiley Eastern Ltd., 4th Edition, 2006.
2. S.C.Arora & S.Domkundwar, *A Course in Power Plant Engineering,* Dhanpat Rai &Sons, 2001
3. Sam. G.Dukelow, *"The Control of Boilers",* 2nd Edition, ISA Press, New York, 1991
4. Gill A.B, *"Power Plant Performance",* Butterworth, London, 1984.
5. David Lindsley, *"Boiler Control Systems",* McGraw Hill, New York, 1991.
6. Jervis M.J, *"Power Station Instrumentation",* Butterworth Heinemann, Oxford, 1993.
7. Modern Power Station Practice, Vol.6, *"Instrumentation, Controls and Testing",* Pergamon Press, Oxford, 1971

EE 357

PROCESS CONTROL

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Process characteristics: Process variables, Process degrees of freedom, Characteristics of physical systems, Elements of process dynamics, Liquid processes, Gas processes, Flow processes, Thermal processes, Dead time, Thermal element lag, Pressure element lag.

UNIT-II

Controller characteristics: Automatic controller, Proportional control, Integral control, Proportional integral control, Proportional derivative control, PID control action, Two position control, Single speed floating control, Electronic controllers, Two position floating controllers.

UNIT-III

Closed loop Automatic control: Effect of closing loop, Proportional control, Integral control, PI control, Derivative control, Static error offset, Velocity error, Ziegler Nichols methods, Two- position control, Single speed floating control.

UNIT-IV

Control Valves: Actuators: Electro-mechanical, Hydraulic, Pneumatic. Valve accessories: Pneumatic valve positioner, Valve limit switches, Solenoid valves, Valves: Selection, Performance, sizing and characteristics.

UNIT-V

Discrete state Process Control: Introduction, Relay controllers and Ladder diagrams, Elements, Examples. Programmable Logic Controllers (PLCs): Introduction, PLC design, PLC operation, Programming, PLC software functions with examples.

Suggested Reading :

1. Eckman D. P, *Automatic Process Control,* Wiley Eastern, 1975.
2. Majumdar S.R, *Pneumatic System,* Tata McGraw, 1995.
3. Curtis D.Johnson, *Process Control & Instrumentation Technology,* 7th Edition, Pearson Education.
4. Bela G.Liptak, *Instrument Engineer's Handbook -Process Control,* 3rd Edition, Gulf Publications.

EE 358

BIOMEDICAL INSTRUMENTATION

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Bio-medical Instrumentation: General Characteristics of medical instrumentation like linearity, range, frequency response, signal to noise ratio and stability. Amplifiers for Bio-medical Applications: Differential, Carrier amplifiers. Phase-sensitive detector for LVDT. Principles of wave generation and shaping. Recorders and display devices for Bio-Medical applications. General features of ink-jet, Thermo-sensitive and optical recorders. General features of display devices for bio-signals. Data-acquisition and display using microcomputers.

UNIT-II

ECG recording system: Block Schematic diagram of ECG machine, Amplifiers and circuits for ECG, Special types of ECG recorders. Noise problems and their elimination.

Electro-encephalography: Block schematic diagram of ECG recording system, General features of different blocks, Specification of ECG amplifiers, Qualitative requirements. 10 -20 electrode system, Resting Rhythms and sleep stages.

Electro Myography: Block schematic diagram of EMG recording system. EMG amplifiers. Design considerations of EMG amplifiers. Data display for EMG.

UNIT-III

Blood pressure and Blood Flows: Electronic Techniques for indirect and direct measurement of blood pressure. Measurement of blood flow by Electromagnetic, Doppler and Plethysmo-graphic methods.

Phonocardiography: Origin of heart sounds, Phonocardiography instrumentation consisting of microphone, filters and signal conditioners.

UNIT-IV

Introduction to Radiography: Physical properties of X-Rays, Principles of generation of X-Rays. Radiation energy distribution, Collimators and grids, Fluoroscopy, Image intensifiers.

Methods of Chemical analysis: Absorption Photometry, Emission photometry, Flurometry, Introduction to auto-analyzer, Chromatography for blood gas analysis. Colorimeters. Spectrophotometers, Electrophoresis.

UNIT-V

Electrical hazards during Bio-electric monitoring: Safety, Codes, Standards, Micro and Macro shock and their physiological effects. Leakage currents and protection by use of isolation transformers, Equi-potential grounding and earth free monitoring.

Electrical factors in Hospital Design: Electrical power supply systems in a Hospital building. Proper installation and grounding for providing safe patient electrical environment.

Recent trends: Medical imaging, X-rays, laser applications, ultrasound scanner, echo cardiography, CT Scan MRI/NMR, cine angiogram, colour doppler systems, Holter monitoring, endoscopy.

Suggested Reading :

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, *"Biomedical Instrumentation and Measurements"*, 2nd Edition, Prentice Hall, New Delhi, 1998.
2. John G. Webstar, *Medical instrumentation -Application & Design,* John Wiley & Sons Inc., 3rd Edition, 2003.
3. R.S. Khandpur, *Hand Book of Biomedical Instrumentation,* Tata McGraw Hill Publishing Company Ltd., 2nd Edition, New Delhi, 2003
4. Joseph J.Carr and John M.Brown, *Introduction to Biomedical Equipment Technology,* Pearson Education, 2001.
5. L. A. Geddes, *Principles of Applied Bio-Medical Instrumentation,* John Wiley and Sons, New York, USA, 1975.
6. Geddes L. A. and Baker L. E., *"Principles of Applied Biomedical Instrumentation"*, 3rd Edition, John Wiley, New York, 1989.
7. Richard Aston, *"Principles of Bio-medical Instrumentation and Measurement"*, Merril Publishing Company, New York, 1990.

CM 371

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Meaning and Nature of Managerial Economics: Managerial Economics its usefulness to Engineers, Fundamental Concepts of Managerial Economics, Scarcity, Marginalism, Equi-marginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT-II

Consumer Behaviour: Law of Demand, Determinants, Kinds; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply, Concept of Equilibrium. (Theory questions and small numerical problems can be asked).

UNIT-III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price – Output determination under Perfect Competition and Monopoly (theory and problems can be asked).

UNIT-IV

Capital Management: Its significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions are numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios).

Suggested Reading:

1. Mehta P.L., "*Managerial Economics – Analysis, Problems and Cases*", Sulthan Chand & Son's Educational publishers, 2011.
2. Maheswari S.N. "*Introduction to Accountancy*", Vikas Publishing House, 2005.
3. Panday I.M. "*Financial Management*", Vikas Publishing House, 2009.

EE 382

POWER ELECTRONICS LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

List of Experiments:

1. S.C.R, BJT MOSFET and IGBT Characteristics.
2. Gate Triggering circuits for SCR.BJT,MOSFET and IGBT using R,RC, UJT and IC's
3. Single Phase step down cyclo-converter with R and RL loads
4. A.C Voltage controllers with R and RL loads
5. Study of forced commutation techniques.
6. Two quadrant D.C.drive.
7. Bridge rectifiers-half control and full control with R and RL loads.
8. Simulation of Single Phase Full converter and Semi converter
9. Simulation of Single Phase and three phase Inverter
10. Buck and Boost choppers
11. Study of 1 KVA UPS and SMPS for variable voltage with constant load, Constant voltage with variable load.
12. V/f Control of AC drive.
13. Single phase inverter with R & RL load.

Note: At least ten Experiments should be conducted in the semester.

EE 332

CONTROL SYSTEMS LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

List of Experiments:

1. Characteristics of D.C and A.C Servo Motors
2. Characteristics of Synchro Pair.
3. Frequency response of compensating networks
4. Step response of second order system
5. D.C position Control System
6. A.C position Control System
7. Closed loop PPI and PID controller
8. Step response and frequency response of a given plant
9. Design of lag and lead compensation for the given plant
10. ON/OFF Temperature Control Systems
11. Temperature control system
12. Level Control System

Note: At least 10 Experiments should be conducted in the semester

EE 384

INDUSTRY – VISIT/STUDY

3 days in Semester	3 x 8= 24 hours
Sessional/Examination	Grade*

Students are expected to visit at least two Industries during the semester and submit a detailed technical report on the study-visits to the Department. Department should evaluate the reports through a committee consisting of Head of the Department and two more faculty members to award the Grades.

** Excellent/Very Good/Good/Satisfactory/Unsatisfactory*