DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/SU/Engg./T.E. Instru. & Biotech./63/2014

It is hereby notified for information of all concerned that, the Dean, has pointed out that, due to **typographical mistake in the Structure of T.E. Instrumentation and Control / Instrumentation and Biotechnology in Subject Code No. BSH-331 Communication Skill-II, the 50 marks shown in the Column of Term Work *should be* in the Column of Practical**.

The Hon'ble Vice-Chancellor has accepted the said typographical mistake to incorporate in above syllabi on behalf of the Academic Council under Section-14[7] of the Maharashtra Universities Act, 1994 under the Faculty of Engineering and Technology.

After above **corrections the said syllabi will be circulated as per Appendix-'A' & 'B'**.

This is implemented for the **Academic Year 2013-2014** and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF. NO. ACAD/SU/ENGG./2014/
1158-82

Date:- 07-04-2014.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload this Circular on University Website.**

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit] Examination Branch,
3] The Superintendent, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,
7] The Public Relation Officer,
8] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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APPENDIX - "A"

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

T.E.

INSTRUMENTATION & CONTROL/

INSTRUMENTATION ENGINEERING.

[Effective from 2013-14 & onwards]

Syllabus of TE (Instrumentation and control/Instrumentation Engg.) Rev.

Syllabus W.E.F. academic year 2013-14 onwards

The following shall be scheme of Instructions and examination **for TE (Instrumentation and control/Instrumentation) Rev.**

Subject No.	Subject	Teaching scheme HRS/WEEK			Examination scheme					Duration of theory paper hrs
		Th.	Pr.	Total	Theory	Term work	Pract.	Class test	Total	
	Part - I									
ICE 3701	**Signal & Systems**	4	2	6	80	25	25	20	150	3
ICE 3702	**Control System Engineering-I**	4	2	6	80	25	25	20	150	3
ICE 3703	**Advanced Microprocessor & Embedded system**	4	2	6	80	25	25	20	150	3
ICE 3704	**Industrial Process Control**	4	2	6	80	25	25	20	150	3
ICE 3705	**Process Equipment Design and Operations**	4	-	4	80	-	-	20	100	3
BSH 331	**Communication skill-II (Online exam common to all branches)**	-	2	2	-	-	50	-	50	-
	Total of part- I	**20**	**10**	**30**	**400**	**100**	**150**	**100**	**750**	-
	Part – II									
ICE 3707	**Digital Signal & Image Processing**	4	2	6	80	25	25	20	150	3
ICE 3708	**Powel Drives and Control**	4	2	6	80	25	25	20	150	3
ICE 3709	**Power Generation and Control**	4	2	6	80	-	-	20	100	3
ICE 3710	**PLC & DCS**	4	2	6	80	25	25	20	150	3
ICE 3711	**Control System Engineering-II**	4	2	6	80	25	25	20	150	3
ICE 3712	**Industrial Visit and Seminar**	-			-	50	-	-	50	-
	Total of part - II	**20**	**10**	**30**	**400**	**150**	**100**	**100**	**750**	-
	Grand total of part I & II	40	20	60	800	300	250	200	1500	-

Note: Following rules are to be follow strictly where ever are applicable.

1. Term Work: Term work shall consist of at least eight assignments/experiments based on the above syllabus. Some of them may be from the above indicated list. Student should submit a journal consisting of the record of experiments performed as indicated above.

2. Practical Examination: The practical examination shall consist of performing the experiments/assignments based on the practical work done during the course, the record of experiments/assignments submitted by the candidate and viva-voce based on the syllabus.

3. Theory Examination:

Pattern of Question Paper:

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Question paper should cover the entire syllabus.

For Theory paper 80 marks:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least ten bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks

Dr. R D Kokate
Chairman (syllabus committee)

ICE3701: Signals and Systems

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

UNIT 1
Introduction to signals and systems
Introduction to signal, classification of signals, basic continuous- time and discrete-time signals, step and impulse functions, transformation of independent variable. Introduction to systems, properties of systems, classification of systems, Normal form of system equations, initial conditions. Impulse response of a physical system, introduction to convolution, system impulse response and convolution integral, convolution sum. **(08)**

UNIT 2
Analysis of continuous and discrete time signals and systems Laplace-transform, convergence of Laplace-transform, properties of Laplace- transform, inversion of Laplace - transform, evaluation of system frequency response, applications of Laplace -transform. Sampling theorem, effect of under sampling in time and frequency domain Z-transform, convergence of Z-transform, properties of Z-transform, inversion of Z-transform, evaluation of system frequency response, applications of Z-transform. **(06)**

UNIT 3
Frequency domain representations and analysis of continuous and discrete time signals and systems Representation of signals in terms of elementary signals, condition for orthogonality, representation of signals by elementary Sinusoids, Fourier series representation of continuous and discrete time signals, Fourier Transform, system function, power spectrum, energy spectrum. Calculation of simple transforms, Discrete time Fourier Transform (DTFT), properties of Discrete time Fourier Transform. **(06)**

UNIT 4
Statistical Signal Analysis Auto correlation function, properties of auto correlation function, measurement of auto correlation function application of auto correlation functions correlation functions, properties of cross correlation Function sectral density, relation of spectral density to autocorrelation function. Auto correlation function of system output, cross-correlation between input and output. **(06)**

Unit 5
Random variables and their analysis Random variables, independent random variable, Probability distribution function, Probability density function. Mathematical expectations: Mean, Variance, Moments.Distribution functions: Uniform, Normal, binomial, Poisson. **(06)**

UNIT 6

Communication Systems Complex exponential and sinusoidal Amplitude modulation, demodulation for sinusoidal AM, Single sideband sinusoidal amplitude modulation, Pulse amplitude modulation, frequency modulation: wideband, narrowband, Discrete time modulation, frequency division multiplexing, time division multiplexing. **(08)**

List of Experiments/Programs

1. Solution of difference equation using recursive method
2. Verify properties of linear convolution (any two)
3. Sampling of a continuous time signal and effect of under sampling
4. Frequency response of discrete time system using D.T.F.T.
5. Auto-correlation and Cross-correlation of discrete time sequences
6. Determination of the Energy spectrum of a discrete time signal by using D. T. F.T.
7. Determination of the spectral density of a discrete time signal by using Autocorrelation
8. Discrete time sinusoidal amplitude modulation

Text Books

1. Gabel R.A. and Robert R.A, Signals and Linear Systems, Third edition, John Wiley and Sons, New York, 1987.
2. Oppenheim, Wilsky and Nawab, Signals and Systems, Second edition, Prentice Hall, New Delhi, 1997.
3. Spiegel, Schiller and Srinivasan, Probability and statistics, Second. edition, Schaum's Outline Tata McGraw-hill edition

Reference Books

1. Cooper G.R and McGillem C.D, Probabilistic Methods of Signals and System Analysis, Third edition, oxford University Press, Cambridge, 1999.
2. C.J Chesmond, Control System Technology, Edward Arnold, London, 1988.
3. Zimmer R.E., Tranter W.H., and Fannin D.R., Signals and Systems, Fourth edition, Pearson Education Asia, Singapore, 1998

ICE3702: Control System Engg.-1

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

Unit 1

Introduction to linear control systems: definitions and elements of control systems, open loop and closed loop control systems, feedback and feed forward control systems, linear and non-linear control systems. **(06)**

Unit 2

a. **Stepper Motor**
Principle, Types, Interfacing with micro-controller (Connection Diagram only), Applications.
b. **Servomotors:** Construction, working, features & Characteristics of AC & DC servomotor AC & DC position & speed control, Synchros, Magnetic Amplifier. . **(07)**

Unit 3

Industrial Control Devices
Switches
Construction, symbolic representation, working, application of Toggle switch, Slide switch, DIP switch, Rotary switch, Thumbwheel switch, Selector switch, Push button, Drum switch, Limit switch, Temperature switch, Pressure switch, Level switch, Flow switch.
Relays
Construction, working, specifications/selection Criteria and applications of Electromechanical relay, Reed relay, Hermetically sealed relay, Solid state relays.
Contactors
Construction, working, specifications and applications of contactors. Comparison between relay & contactor **(07)**

Unit 4

Sequencing & Interlocking for motors ,Concept of sequencing & Interlocking:
Electrical Wiring Diagram, Standard symbols used for Electrical Wiring Diagram,
Wiring diagrams in relation to motors

1. Starting, Stopping, Emergency shutdown, (Direct on line, star delta)
2. Protection of motors: Short circuit protection, Over load Protection, Low/Under Voltage
3. Protection, Phase reversal Protection, Over temperature Protection
4. Reversing direction of rotation
5. Braking
6. Starting with variable speeds
7. Jogging/inching
8. Motor Control Center: Concept and wiring diagrams **(08)**

Unit 5

Pneumatics

Pneumatic components

Pneumatic Power Supply and its components

1. Pneumatic relay (Bleed & Non bleed, Reverse & direct)
2. Single acting & double acting cylinder
3. Special cylinders: Cushion, Double rod, Tandem, Multiple position, Rotary
4. Filter Regulator Lubricator (FRL)
5. Pneumatic valves (direction controlled valves, flow control etc)
6. Special types of valves like relief valve, pressure reducing, etc.
7. Time delay valve
8. Air motors

Pneumatic Circuits

1. Sequence diagram (step-displacement) for implementing pneumatic circuits
2. Standard Symbols used for developing pneumatic circuits
3. Different Pneumatic Circuits: Reciprocating, Sequencing, Anti-cycle repetition, Block Transfer, Speed regulation etc. **(06)**

Unit 6

Hydraulics

Hydraulic components: Hydraulic supply Hydraulic pumps, Actuator (cylinder & motor) Hydraulic valves, Hydraulic Circuits.

1. Standard Symbols for developing hydraulic circuits
2. Different Hydraulic Circuits: Meter in, Meter out, Reciprocating, speed control, Sequencing of cylinders, Direction control etc. . **(06)**

List of Experiment: (Any eight experiment)

1. Implementation of Logic Gates using relays.
2. Study of various pneumatic and hydraulic components and power supplies.
3. Implementation and testing of Pneumatic circuits.
4. Implementation and testing of Hydraulic circuits.
5. Study of Synchro transmitter and receiver system
6. Study of Pressure / temperature/level / flow Switches (any two).
7. Study of Motor control Center based on industrial visit.

Text Books

1. Electrical Technology, B.L.Theraja.
2. Industrial Electronics, Petruzella
3. Pneumatic Majumdhar
4. Industrial Hydraulics, Pipenger

Reference Books:

1. Pneumatics, Festo Didactic
2. Hydraulics, Festo Didactic
3. Process control and Instrument technology, C.D.Johnson, TMH.

ICE3703: Advanced Microprocessor and Embedded System

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

Unit 1
8086 CPU, architecture, advantages of segmentation, addresses modes. 8086 instruction set, use of MASM, assembler directives in 8086 programming, programs related to Arithmetic, logical, code conversion, string manipulation operation. Writing programs using Procedures and macros. **(07)**

Unit 2
Interrupt structure of 8086 CPU, hardware and software interrupts, elementary programming using Interrupt services. Introduction to microcontrollers: Comparison of microprocessor and microcontrollers 4-bit, 8-bit, and 16-bit microcontrollers. **(06)**

Unit 3
8051 Architecture: Pin out diagram, 8051 oscillator and clock, Program counter and Data Pointer, A and B CPU registers, Flags and PSW, internal memory, stack and stack pointer, SFRS, internal ROM, i/p and o/p ports. **(07)**

Unit 4
Assembly language programming for 8051 microcontroller instruction classification, instruction set Arithmetic and logical operations, jump and call instructions etc., Writing assembly language programming based on instruction set, stacks and subroutines. **(07)**

Unit 5
Introduction to Embedded Systems, Embedded Systems, processors in Systems, Other H/W units, Software Embedded into a System, Exemplary Embedded Systems, and Embedded System On chip (SOC) & VLSI Circuit.

Processor & Memory Organization Structural Units in a Processor, Processor selection in Embedded System , 8/16/32 bit microcontrollers, Memory devices, Memory selection for Embedded System allocation of memory to program segments and blocks and memory maps of system. Direct memory access. Interfacing processor, memories and I/O devices. RISC and CISC processor, ARM processor. **(08)**

Unit 6

Devices and buses for Devices Networks. I/O devices, Timer and Counting devices, Serial communication using I^2C, CAN and advanced buses. Computer parallel communication between networks ISA, PCI, PCI-X, advanced buses.

Case studies of Programming and Application of ES in instrumentation different application cruise control of CAR, automatic chocolate vending machine. **(05)**

Recommended Books:

1. Hall D. V, "Microprocessor Interfacing" Prentice Hall India.
2. Gibson L. "8086/8088 Microprocessor: hardware and software" Prentice Hall India, 2002,2/e
3. Brey B.B, "The Intel Microprocessors" Prentice Hall India, :2000, 4/e
4. Intel Corporation, "Microsystems Components Handbook: Microprocessors and peripherals", vol. 1 and 2
5. Ayala K.J, "The 8051 Microcontroller" Penram International, 1996, 2!e
6. "The 8088 & 8086 Microprocessor Programming, Interfacing Software, Hardware" Pearson Education,4/e
7. Uffcnbeck J, "The 8086family.Design, Programming & Interfacing" Pearson Education, 3/e
8. Mazidi M.Ali: 8051 Microcontroller Embeded System, Pearson Education 2000,1/e
9. Embedded systems –Raj Kamal
10. Embeded system design – Jhon Wiley
11. Embedde soft Primer-David Simon
12. Embedded Linux-Craig Hollabaugh
13. Fundamentals of Embedded software-Daniel Lewis
14. Embedded C Programming and Atmel A VL – Barnett Cox

Practical Examination:

The practical examination shall consist of performing the experiments/programs (at least eight) based on the practical work done during the record of experiments submitted by the candidate and viva-voce based on the syllabus.

ICE3704: Industrial Process Control

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

Unit 1

Process characteristics: Types of Processes (Dead time, single & multicapacity, self & non self regulating, interacting, Linear & non Linear Processes), Process gains, process reaction curve, Process time constant and constant step analysis method for finding time constant, dead time, Dynamic elements in control loops

Controllers: Two position, multiposition control, floating control, proportional plus rate, proportional plus reset, proportional plus reset plus rate control actions, pneumatic, electro pneumatic, electrical / electronic, hydraulic, electro-hydraulic controllers. Algorithms of PID, and Designing of PID in pneumatic and electronic systems. **(07)**

Unit 2

Control Valves & Actuators: Designing control valve for gas, vapor and liquid Effects and remedies of cavitations, flashing condition, noise, control valve linearizer, valve auxiliary parts, flow characteristics of valve, control effect of load changes, high pressure & high temperature service control valve, installed range ability and viscosity correction for control valve. Control valve application & selection, valve sizing. Control valve seat leakage, valve noise calculation and reduction methods. Smart valve packages. Intelligent-smart actuators, design considerations for actuators (Solenoid, Pneumatic, Hydraulic, Digital Bus actuators). **(08)**

Unit 3

Analysis and properties of some common loops: Flow, Pressure level, temperature, composition, pH etc.

Multiloop and multivariable process control systems: Feedback, feed-forward control, cascade control, ratio control, auto selective control, and split-range control. Interaction and decoupling, C-M Relative Process Gain Matrices (RPG) and applications. Robust control statistical process controls. **(05)**

Unit 4

Process components: Design aspects and selection criteria for flow, temperature, pressure & level transducers, SMART & intelligent transmitter with control capability, hand held terminals specification standards and recommended practices for instruments, field bus components & field bus controller Designing Analog and Digital Signal Conditioners (mV to 0-5 to 4-20mA, 0-5 to 0-FFH) Photoelectric and Proximity Sensors. Safely Switches and Limit switches. **(07)**

Unit 5

Boiler Instrumentation and optimization: Boiler Equipment, Safety Interlocks by PLC, Boiler Efficiency and Dynamics. Boiler Controls: Combustion Control, Air to Fuel Ratio Control, 3 – element drum level control, steam pressure control, steam temperature control, burner management and control, boiler optimization. Furnace control, FB-FF-CS of Heat Exchanger, steam and fired heaters control, Reboilers, Vaporization and Condenser's Control. **(07)**

Unit 6

Pumps and Compressor Controls: Types of pumps, Flow pressure and pump speed control at constant load, types of variable speed drive, multiple pump stations. Types of Compressors, interlocks in Compressors. Surge in Compressors and anti-surge control system. Microprocessor based control for compressor optimization. Interlocks in Compressors. Surge in Compressors and Anti-surge Control System. Microprocessor based control for compressor optimization. **(06)**

Term work:

The journal shall consist of a record of six experiments/ programs from the list given below.

1. Study of process transducers (Electronic Type)
2. Study of multiloop control cascade control.
3. Study of ON – OFF electronic temperature control.
4. Study of optimum controller settings using computer
5. Study of control valve characteristics.
6. PC/ microprocessor/PLC based temperature/Level/pressure control system
7. Study and configuration of 'SMART' transmitter

8. Study of calibrators (Temp., pressure.)

Practical Examination:

The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiments submitted by the candidate and vice voce on the syllabus.

Recommended Books:

1. F. G. Shinsky: Process control systems, application, Design Tuning: Mc – Graw -Hill, International Edition, 1998
2. C. D. Johnson: Process Control Instrumentation Technology
3. George Stephanopoulos: Chemical process contol(PHI)
4. Peter Harriot: Process control, Tata Mc Graw Hill, 1984
5. Donald Eckman: Automatic process control, Wiley Eastern Ltd., 1975.
6. D. Patranabis: Principles of process control, Mc Graw Hill 1987.
7. Conghanower and L.B. Koppel: Process system analysis and control, Mc Graw Hill, 1965.
8. Liptak B. G: Hand Book of process control.
9. Computer based Industrial Control by Krishna Kant (PHI)
10. Feedback controllers – Tuning, Applications and Design by F.G. Shinskey (TMH)

ICE3705: Process Equipment Design and Operations

Teaching Scheme
Lectures: 4 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks

Unit 1
Heat exchanger equipments I: Prerequisites, overview of process equipments in various industries, applications, heat transfer fundamentals. General design requirements, shell & tube type, plate type heat exchangers, fundamental principal, application, fabrication.
Calculation of heat transfer coefficient, condensers: type, working, application. **(08)**

Unit 2
Heat exchanger equipments II: Boilers: types, working, application, components, fabrication.
Jacketed agitated vessels: CSTR, evaporators: types, working, application, components, fabrication & heat transfer coefficient. Capacity economy efficiency of the equipments. Parameters associated in design. **(06)**

Unit 3
Distillation: types, continues & batch, sieve plate & packed column, height & diameter relation of distillation column. Overall design aspect: material, fabrication, mass transfer calculations, energy balance & material balance. Rectification, striping, fractionating column & application. **(06)**

Unit 4
Mass transfer equipment: Leaching & extraction, gas absorption, drying of solids, crystallization: equipment setup requirements, working, fabrication, mass transfer calculations, and applications. **(08)**

Unit 5
Mechanical operations: Mixing of solids, size reduction, and screening: types, equipment setup, working principal.
Filtration: Cake filters, centrifugal filters, clarifying filters & equipment setup.
Settling & Sedimentation: gravity & centrifugal settling and equipment setup. **(06)**

Unit 6
Industrial Piping & fluid moving machinery: Fundamentals of pipe, types, sizing, material & treatment according to services- liquid or gases. Pipe layouts and fittings, factors under considerations, calculations of losses in pipes, valves, blowers, pumps and compressors. **(06)**

Reference Books:

1. Mass transfer operations, R.E. Treybl, Mcgraw Hill publications.
2. Unit operations & chemical engineering, W.L.Mccav & J.C.Smith, Tata Mcgraw Hill publications
3. Unit operations, C.G.Brown.
4. Chemical Engineers handbook, R.H.Perry, Mcgraw Hill publications.
5. Mass transfer, T.K.Sherwood, Mcgraw Hill publications
6. Process equipment designing, Brown well & Young
7. Process equipment designing, Dr. S.D.Dawande

BSH331 LAB-V COMMUNICATION SKILLS-II

Teaching Scheme
Practical: 2 Hrs/Week

Examination Scheme
Online Examination:50 Marks (1 Hr.)

Unit-I

- Fast calculation techniques, Number system, ratio ,proportion, variations averages,
- Simple interest ,compound interest, profit, loss
- Work and time speed and distance
- Set theory and vann diagram, permutation and combination
- Probability, alphanumeric series, logical deduction, reasoning, coding and decoding and blood relation
- Data interpretation

Unit-II

- The key components of non verbal communication i.e. eye contacts, body language, vocal tone and volume.
- Team work and team building, The basics of team intelligence, Diversity awareness, Gender issues
- Group discussion, unstructured group discussions and actual group discussions
- Presentation skills ,self confidence and decision making

Unit-III

- Adapting to corporate life
- Phone etiquettes, Email etiquettes, clothing etiquettes, Dinning table etiquettes
- Getting ready for an interviews, corporate dressing, writing reports and proposals, minutes writing.

Reference Books

1. Gopal Swamy Ramesh,Mahadevan Ramesh ,"The Ace of soft skills", Pearson Publication
2. Bansal Harison, "Spoken English"
3. Orient Blackswan, "English for Engineers and Technologist"
4. Jerry Wiessman , "Presenting to Win" Pretince Hall publications
5. Willium Sanborn Pfeiffer, T.V.S, Padamaja, "Technical Communication"
6. M. Tyra, "Magical book on Quikermaths" BSC Publishing Co. pvt.ltd.

PART-2

ICE3707: Digital Signal and Image Processing

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

Unit 1

The Discrete Fourier Transform, It's Properties And Applications:

Frequency Domain Sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform (DFT) : The DFT as a Linear Transformation, Relationship of DFT to The Z Transform, Properties of The DFT : Multiplication of Two DFTs and Circular Convolution, Problems Based on DFT Properties Linear Filtering Methods Based on DFT, Filtering of Long Data Sequences : Overlap Add Method , Overlap Save Method, Fast Fourier Transform (FFT) Algorithms : Divide And Conquer Approach ,Radix 2 FFT Algorithms, Decimation in Time FFT, Decimation in Frequency FFT, Computation of Inverse DFT using FFT algorithms, Gortzel Algorithms. **(07)**

Unit 2

IIR Filter Design:

Infinite Impulse Response (IIR) Filters and Its Properties, Design of IIR Filters From Analog Filters : IIR Filter Design By Approximation of Derivatives, Impulse Invariance Method, Bilinear Transformation Method, The Matched Z- Transformation Specification of low pass filter : Design of Low pass Digital Butterworth Filter, Design of Low pass Chebyshev filter, Frequency Transformations in analog Domain, Frequency Transformations in digital domain. **(07)**

Unit 3

FIR Filter Design:

Introduction, Symmetric and Anti symmetric FIR Filters, Stability of Optimal FIR Filters, Design Methods of FIR Filters: Design of Linear Phase FIR Filters Using Fourier series method, using Windows & Using Frequency Sampling Method. **(06)**

Unit 4

Fundamentals of Image Processing:

Image Acquisition, Image Model, Sampling, Quantization, and Relationship between pixels and distance measurement, connectivity, Image Geometry, Photographic film. Histogram: Definition, Decision of Contrast biasing on histogram, Operations based on histograms like image stretching, Image classification. Definition and Algorithm of Histogram equalization **(08)**

Unit 5

Image Transforms:

Introduction to Fourier Transform, The Discrete Fourier Transform, Properties of two dimensional Fourier transform, Fast Fourier Transform, WALSH Transformation, HADAMARD Transformation, DCT **(06)**

Unit 6

Image Enhancement: Image Enhancement (by Spatial Domain Methods):

Arithmetic and Analytical operations, pixel or point operations, size operations) Smoothing filters – Mean, Median, Low pass filters, high pass filters, sharpening filters.

Image Enhancement: (by Frequency Domain Method): Design of Low Pass, High Pass, Edge enhancement, Sharpening filters in frequency domain. Butterworth Filter, Homomorphic filters in frequency domain and spatial domain. **(06)**

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, 4th Edition, PHI, 2007.
2. Sanjit K Mitra, Digital Signal Processing: A Computer-Based Approach, 3rd Edition, McGraw- Hill.
3. B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003.
4. Salivahanan,Vallavraj, Gnanapriya, Digital Signal Processing, Tata McGraw Hill
5. Rabiner, Gold, Theory and Applications of Digital Signal Processing, Prentice Hall
6. Digital Image Processing, BY Rafael C Gonzalez, Richard E Woods, Pearson Education.
7. Digital Image Processing using MATLAB", BY Rafael C Gonzalez, Richard E Woods, Eddins, Pearson Education.
8. Fundamentals of Digital Image Processing, BY Anil K Jain, PHI.

ICE3708: Power Drives and Control

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

UNIT 1
Power Devices
Silicon Controlled Rectifiers:-Construction, turn on Methods, turn off Methods, V-I Characteristics, dynamic Characteristics of SCR, gate Characteristics, Introduction to heat transfer Process, Protection circuits. Power diode, Power BJT, Power MOSFET, IGBT, GTO, Triac, Diac, UJT & PUT. **(08)**

UNIT 2
Thyristor Commutation Techniques & Firing Circuits
Principle of Natural commutation, Forced commutation circuits: Self commutation, Impulse commutation, resonant pulse commutation, Complementary commutation, External pulse commutation. Basic Block diagram of firing circuit. R, RC Half Wave, RC Full Wave & UJT Firing circuits, Triggering Circuit for Triac using Diac. **(06)**

UNIT 3
Phase Controlled Rectifiers
Single phase Controlled rectifiers: Half wave, Center tapped, Bridge (half controlled and fully controlled) with R, RL load, with & without Free Wheeling Diode.
Three phase Controlled rectifiers: Half wave, Bridge with R and RL load. Effect of source inductance on Controlled rectifiers, voltage and current harmonics analysis, dual converters. Power factor improvement methods. **(06)**

UNIT 4
DC chopper (Using SCR):
Principle of Operation of step up chopper, Step down, Morgan chopper, Jones chopper.
Inverters(Using SCR): Single phase inverters: series, parallel and bridge configurations with R load, PWM inverters. Three phase inverters with 120° and 180° conduction with R and load RL.
Cyclo-converters(Using SCR): The basic principle of operations of single phase Step up & step down Cyclo-converter. **(08)**

UNIT 5
Speed control of DC & AC motors
Using different rectifiers, principles of regenerative braking, principles of two/ four quadrant chopper drives, control using multiphase choppers, microprocessor control of DC drives. Stator voltage control, rotor voltage control, frequency control, voltage and frequency control, microprocessor control of AC drives. **(05)**

UNIT 6

Applications:

Power Controlled Circuit, Static AC & DC circuit Breakers, Over voltage Protection, Zero voltage Switching, Integral Cycle triggering, Time delay circuits, Soft start circuits, logic Digital circuits, battery charging, Illumination control circuit & UPS. **(07)**

Term Work: The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

1. SCR characteristics.
2. Triac characteristics.
3. Diac Characteristics
4. UJT as Relaxation Oscillator.
5. Power control using SCR.
6. Power control using Triac.
7. Single phase converters.
8. Single phase inverter.
9. Step Up & Step Down chopper
10. Study of D.C. motor control using controlled rectifiers & Chopper.
11. Study of A.C. motor control using inverter.
12. Study of Zero voltage Switching.
13. Universal motor control.

Reference Books:

1. M. H. Rashid, "Power Electronics: Circuits, Devices, and Applications", Prentice Hall of India Private Limited, New Delhi-110 001(India), Second Edition, 1994.
2. M. D. Singh, K. B. Khanchandani, "Power Electronics", Tata McGraw-Hill Publishing Company Limited, New Delhi (India), 1998.
3. Dr. P. S. Bimbhra, "Power Electronics" Khanna Publishers, Delhi-110 006 (India), 2nd Edition, 1998.
4. M. Ramamooty, "An Introduction to Thyristors and Their Applications", Affiliated East-West Press Private Limited, New Delhi-110 020 (India), 2nd Edition, 1991.
5. N. K. De, P. K. Sen, "Electric Drives", Prentice Hall of India Private Limited, New Delhi-110 001(India), 1999.
6. G. De, "Principles of Thyristorised Converters", Oxford and IBH Publications.
7. Element of Power Electronics – Philip T. Trein – Oxford Higher Education.

ICE3709: Power Generation and control

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

UNIT 1

Introduction to different types of power plants and their salient features. Thermal power plant, Hydro Electric power plant, Gas turbine power plant Nuclear power plant

Introduction of process in power plant: Raw materials, different fuels, water feed, water steam cycle, gas air cycle, steam generators, different types of turbine, types of hydro turbines, steam turbines and gas turbines, power generating and distributing system, cooling towers. **(08)**

UNIT 2

Combined operations of different power plants: Introduction, advantages of combined working, load division between power stations, combinations such as hydroelectric power plant with steam plant, co-ordination of hydroelectric and gas turbine stations. **(08)**

UNIT 3

Measurements in power plants: Importance of measurement and instrumentation in power plant, flow measurement, feed water, fuel, airflow, steam flow measurement and correction factor for temperature and pressure, temperature measurement, pressure measurement, level measurement, smoke, density measurement, radiation detection instrument. **(04)**

UNIT 4

Control loops and interlocks: Combustion control, air/fuel ratio, furnace draft and excess air control drum level control or three element control, reheat steam temperature control, super heater spray and gas recirculation control. Water recirculation and types of water cooling methods

Turbine monitoring and control: Speed, vibration, shell temperature, monitoring, lubricating oil temperature control, and hydrogen generator cooling system. **(08)**

UNIT 5

Auxiliaries in power plant: air system, ID, FD fans, make up water treatment plant, de-super heaters, air pre-heaters, soot blowers, different control valves and efficiency. Use of feed

forward and cascade control. Instrumentation and control in reactors, their types, which are used in, process industries. **(04)**

UNIT 6

Analytical instruments: Analysis, chemical method & instrumental method, colorimeters, refractometers, cromatograph, spectrometers- infrared, NMR, atomic absorption, spectrometer, principal setup of instrument, applications.

Environmental monitoring instruments: Flourimeter, phosphori meter, turbidity meter, air pollution & water pollution monitoring instruments (working principal, instrument setup, features and applications) **(08)**

Recommended Books:

1. F.T. Morse: " Power plant engineering", East west Press Ltd.
2. Domkundwar V.: "Power plant engineering", Dhanpat Rai & co. Ltd. Delhil – 2001
3. B.G. Liptak: "Instrumentation in Process Industries ", Butterworth & Heinmann 1999
4. Nag: "Power Plant Engineering ", Tata McGrawHill Publishing 2000
5. Yadav: "Steam and Gas Turbines ", Central Book Depot, Aallahabad
6. Willard, Merritt, Dean & Settle, "Instrumental Methods of Analysis" , CBS Publishers & Distributors, New Delhi, Seventh edition.
7. Galen W. Ewing, "Instrumental Methods of Chemical Analysis" , McGraw-Hill Book Company, Fifth edition
8. Dr.R.S.Khandpur, "Analytical instrumentation" Tata McGrawHill Publication.

ICE3710: PLC and DCS

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

UNIT 1

Programmable logic controllers (PLC): Introduction, architecture, definition of discrete-state process control, discrete – state variables, process specifications, Event sequence description, ladder diagram: Background, ladder diagram elements ladder diagram examples, programmable controllers: Relay sequencer, programmable controllers, programmable controller operation, programming, advanced features, ladder diagrams and programming for some typical examples of process control study of at least one industrial PLC make. **(8)**

UNIT 2

Introduction to supervisory control and data acquisition (SCADA) as applied to process control systems. Introduction to Hierarchical control memory optimization of empirical process. Personal computers (PC) in process control direct digital control distributed process control, advanced process control (APC) **(8)**

UNIT 3

DCS configuration: Supervisory computer functions, control techniques, Supervisory control, algorithm DCS and supervisory computer displays, Advanced control strategies computer interface with DCS. **(04)**

UNIT 4

Data highways, field buses, multiplexers and remote sensing terminal units. I/O hardware, set point stations, CRT displays printers and operators interface. Supervisor computer tasks and configuration. **(07)**

UNIT 5

Systems integration with PLC's and computer (Hybrid Control System). Network protocols, MAP/TOP **(07)**

UNIT 6

Study of TDC-3000, Rs-3, ABB MOD 300: Yokogawa centum –CS (At least two) **(06)**

Term Work: Term work shall consist of at least six to eight assignment/tutorials/practical based on above syllabus. Some of the experiments may be from the following list.

1. Study of Any one PLC module.
2. Developments of Ladder diagram for the controlling motor operation
3. Development of ladder diagram and Simulation for the level control system.
4. Development of Ladder diagram for bottling plant.
5. Study of Software package for SCADA
6. Development of mimic diagram for a particular process using SCADA software
7. Study of Logo PLC
8. Development of Ladder diagram using logo software for different processes.

Reference Books:

1. Gary Dunning, "Introduction to Programmable Logic Controllers" Second Edition, Thomson Delmar learning, 2002.
2. C. D. Johnson, "Process Control Instrumentation Technology" Seventh Edition, Pearson Education, New Delhi 2003.
3. Instrument Engineers handbook –B. G. Liptak (Ed) Vol-II and III, Chilton book Company.
4. Technical Manual – Manuals of TDC – 3000 Rs-3, ABB MPD 300 Yokogawa centum-CS
5. Distributed control system – M. Lucas
6. Distributed control system – Peter and Bhatkar
7. Webb J. W., "Programmable Controllers: Principles and Applications", Mergy/publishing co. 1988
8. Parr A. "Programmable Controllers: An Engineer's Guide", Newnes, Butterwoth-Heinmen Ltd. 1993.
9. C. D. Johnson, "Microprocessor based Process Control", Prentice Hall International Edition.

ICE3711: Control System Engineering-II

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week
Class test: 20 Marks

Examination Scheme
Paper: 80 Marks
Term work: 25 Marks
Practical: 25 Marks

UNIT 1

Mathematical modeling of dynamic systems: Writing differential equations for any given (e g. Mechanical, electrical, hydraulic, pneumatic, thermal, liquid-level etc) control systems and their Transfer function determination, analogous systems, block diagram, representation and reduction Technique, signal flow graph construction, terminology, Algebra and Masson's gain formula **(04)**

UNIT 2

Time-domain analysis: Standard test signals, Transient response of First order and second order System, physical examples of first and second order system and their analysis. (e.g. liquid level), Systems, electrical systems, control valve actuators.) Transient response specifications, steady state Error and error constants. Effect of integral and derivative control action or system performance. Performance index concept and error performance indexes ISE, ITSE, IAE, ITAE. **(08)**

UNIT 3

Stability of control system: Determination of stability of a control system, Routh-Hurwitz criteria, Root locus technique, and root counters effect of adding a pole/zero on stability, performance Specifications in time domain, application of root locus to control systems.**(08)**

UNIT 4

Frequency domain analysis: Performance specification, correlation between time domain and Frequency domain specification. Use of log magnitude and phase angle curves- Bode plots in determining the stability and performance; of closed loop control systems, effect of addition of pole/zero on control system performance, Mapping theorem, determination of stability using Nyquist: stability criteria gain margin and phase margin, effect of adding a pole/ zero on : stability, constant M & N loci. Use of Nichol's chart in determining the closed loop performance from the open loop results. **(08)**

UNIT 5

Frequency domain design of control systems: The design problem, preliminary consideration of classical design, realization of basic Compensators, cascade compensation in frequency domain, phase lead, lag, lead-lag controllers (Electrical, electronic & mechanical type), their transfer function, Bode plot, polar plots, design. Procedure, effects & limitations, feedback compensation in frequency domain **(08)**

UNIT 6

Time domain design of control systems: Cascade compensation in time domain lead, lag, Lead-Lag compensation using root locus techniques, pole-zero cancellation control, Bridge – T networks &cascade compensation using them, principle of compensation in AC system. **(04)**

Recommended books:

1. Nagrath I.J. & M. Gopal . Control system engg. (second edition) Wiley Eastern Ltd. 1985
2. Ogata K.: Modern Control Engg. (third edition) Prentice Hall of India. ,
3. B.C.Kuo. Automatic Control System. (fifth edition) Prentice Hall of India.
4. Raven: Automatic control engg. .TMH.5/e
5. Goodwin. Control System Design, PHI
6. Nise N.S: Control Systems, John Wiley and Sons. Inc
7. Design of Feedback control Sysems – Raymond T.Stefani – Oxford Higher Education

Term-Work:

The students are expected to perform a set of 8 experiments based on the syllabus, which may

Include the following:

List of Experiments:

1. Programs for calculating transfer function.
2. Programs for basic plot, Bode, Root locus, Nyqusit, polar etc.
3. Programs for plotting the responses for standard test signals.
4. Programs for piloting transient response of first and second order systems.
5. Programs for Routh and Hurwitz stability test.
6. Programs for P I D control actions in time domain.
7. Programs for time domain compensator design.
8. Programs for frequency domain compensator design.

Student should submit a journal consisting of the record of experiments performed as indicated Above.

ICE3712: Industrial visit and Seminar

Examination Scheme
Term work: 50 Marks

The term work will consist of a report prepared by every student on the seminar topic allotted to them and External oral presentation. The student is expected to submit the seminar report in standard format. The topic for the seminar should necessarily be out of syllabus and relevant to the latest trends in Instrumentation and Control.