DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/Engg./B.E.IIIrd Yr./64/2018

It is hereby informed to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faulty of Science & Technology the **Academic Council at its meeting held on 30 June & 02 July 2018 has accepted the following syllabi in accordance with Choice Based Credits & Grading System for all Branches Third Year Engineering & Second Year of Bachelor of Architecture** under the Faulty of Science & Technology as enclosed herewith:-

Sr.No.	Syllabi as per CBC & GS
[1]	Third Year B.E.[Civil Engineering],
[2]	Third Year B.E [Mechanical Engineering],
[3]	Third Year B.E [EE/EEE/Electrical, Electronics & Power,],
[4]	Third Year B.E [Chemical Engineering],
[5]	Third Year B.E [Instrumentation Engineering],
[6]	Third Year B.E [E&TC/E&C/IE/ECT],
[7]	Third Year B.E [CSE/IT].
[8]	Second Year of Bachelor of Architecture.

This is effective from the Academic Year 2018-2019 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.SU/2018/
Date:- 03-07-2018. / 10497 -03

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6/7/18
Deputy Registrar,
Syllabus Section

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 Director, Board of Examinations & Evaluation,
2] The Section Officer, [Engineering Unit] Examination Branch,
3] The Section officer, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The In-charge, [E-Suvidha Kendra],
7] The Public Relation Officer,
8] The Record Keeper,

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under Choice Based Credit & Grading System

Revised Syllabus of

Bachelor of Engineering

Third Year

Instrumentation

/Instrumentation & Control Engineering

Under the Faculty of Science & Technology

[Effective from the Academic Year 2018-19 & onwards/-

Revised Syllabus of T. E. (Instrumentation/Instrumentation and Control Engineering)

Sub Code / Faculty Name	SEMESTER-V	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	P	Total	Credits	Duration of Theory
ICE 301	Signals and Systems	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 302	Control System Components	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 303	Advanced Microprocessor and Microcontroller	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 304	Process Instrumentation	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 305	Elective I	4	-	-	4	20	80	-	-	100	4	3 Hrs
BSH 305	Communication Skills-II	2	-	-	2	-	-	50		50	2	2Hrs/Week
ICE 321	Lab I: Signals and Systems	-	-	2	2	-	-	-	50	50	1	
ICE 322	Lab II: Control System Components	-	-	2	2	-	-	50	-	50	1	
ICE 323	Lab III: Advanced Microprocessor and Microcontroller	-	-	2	2	-	-		50	50	1	
ICE 324	Lab IV: Process Instrumentation	-	-	2	2	-	-		50	50	1	
	Total	**20**	**-**	**10**	**30**	**100**	**400**	**100**	**150**	**750**	**26**	

Sub Code / Faculty Name	SEMESTER-VI	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	P	Total	Credits	Duration of Theory
ICE 351	Digital Signal and Image Processing	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 352	Power Electronics	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 353	Control Engineering	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 354	Control System	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 355	Elective-II	4	-	-	4	20	80	-	-	100	4	3 Hrs
ICE 371	Lab V: Digital Signal and Image Processing	-	-	2	2	-	-		50	50	1	
ICE 372	Lab VI: Power Electronics	-	-	2	2	-	-		50	50	1	
ICE 373	Lab VII: Control Engineering	-	-	2	2	-	-		50	50	1	
ICE 374	Lab VIII: Distributed Control System	-	-	2	2	-	-	50		50	1	
ICE 375	Seminar	-	-	2	2	-	-	50		50	2	
	Total	**20**	**-**	**10**	**30**	**100**	**400**	**100**	**150**	**750**	**26**	
	Grand Total of V& VI									**1500**	**52**	

L: Lecture hours per week T: Tutorial hours per week P: Practical hours per week CT: Class Test
TH: University Theory Examination TW: Term Work P: Practical/Oral Examination

Elective I: 1. Process Equipment Design and Operations
(ICE305) 2. Optoelectronics Instrumentation
3. Agriculture Instrumentation

Elective II: 1. Power Plant Instrumentation
(ICE355) 2. Robotics
3. Analytical Instrumenta

Note: Following rules are to be followed strictly wherever 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

PART-1

ICE 301: Signals and Systems

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

Examination Scheme
Paper: 80 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)**

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

ICE 302: Control System Components

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

Examination Scheme
Paper: 80 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)**

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.

ICE 303: Advanced Microprocessor and Microcontroller

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

Examination Scheme
Paper: 80 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

ICE 304: Process Instrumentation

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

Examination Scheme
Paper: 80 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)

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)

ICE 305: Elective-I
(1)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

(2) Optoelectronics Instrumentation

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

Examination Scheme
Paper: 80 Marks

1. Light and Elements of solid state physics nature of light, wave nature of light, light sources black body radiation, units of light Energy bands in solids, semiconductor types, works function, functions. **(4)**

2. DISPLAY DEVICES: Luminescence, Insertion Luminescence and the light emitting diode, Radiative recombination processes LED materials, commercial LED materials LED construction, response time of LEDs, LED drive circuitry plasma display liquid crystal displays. **(5)**

3. LASERS: Emission population inversion, optical feedback classes of laser, doped insulator lasers semiconductor lasers, gas lasers, liquid dye lasers, laser applications, measurement of distance holography. **(8)**

4. PHOTODETECTOR: Thermal detectors: thermoelectric detectors, the bolometer, pneumatic detector, pyroelectric detector photo devices photo emissive devices vacuum photo diodes photo multipliers, noise in photo multipliers, image intensifier photo conductive detection photo transistor etc. **(6)**

5. OPTICAL FIBERS: Classification of optical fiber, principle of light transmission through a fiber, fabrication of optical fibers, material consideration loss and band width limiting mechanism, preform fabrication technique, fiber drawing, fiber optic communication system introduction to fiber optic sensors: Temperature pressure, level etc. **(6)**

6. OPTO ELECTRONIC POWER DEVICES: Solar cells and their application. **(3)**

7. OPTO ISOLATORS: Different types and their configuration applications. **(3)**

8. OPTICAL INSTRUMENTS: Calorimeter, spectrophotometer, flame photometer fluorimeter and turbidity meter. **(5)**

REFERENCE BOOKS:

1. Semiconductor Optoelctronic Devices, Second Edtion, Pallab Bhattacharya, Pearson Education, New Delhi, 2002.
2. Opto Electronics – An Introduction J. Wilson J.F.B.Hawkes, Prentice Hall of India New Delhi 1996.
3. Integrated circuits and semiconductor devices: theory and application – Deboo Burrous McGraw Hill second edition.
4. Optical fiber communications Principals and Practice J. M. Senior Prentice Hall of India, second Edition, 1996.
5. Fiber optics – communication and other application H. Zanger and C. Zanger McGraw Publication
6. Optical Fiber Communication, Gerd Keiser

(3) Agriculture Instrumentation

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

Examination Scheme
Paper: 80 Marks

1	Introduction: Necessity of instrumentation and control for food processing and agriculture sensor requirement, remote sensing, biosensors in Agriculture, standards for food quality Instrumentation for food quality assurance: Instrumental measurements and sensory parameters.	**(6)**
2	Inline measurement for the control of food processing operations: color measurements of food, food composition analysis using infrared, microwave measurements of product variables, pressure and temperature measurement in food process control, level and flow measurement in food process control, ultrasonic instrumentation in food industry. Instrumental techniques in the quality control.	**(8)**
3	Major Processes: Flow diagram of sugar plant, sensors and instrumentation set-up for it, Oil extraction plant and instrumentation set-up, Juice extraction control set-up	**(6)**
4	Instrumentation for Agriculture: Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems & it's performance, comparison of different irrigation systems, soil moisture measurement methods	**(7)**
5	Major Processes: Application of SCADA for DAM parameters and control, Water distribution and management control, Auto-Drip irrigation systems, Irrigation Canal management, upstream and downstream control concepts, supervisory control	**(7)**
6	Green houses and Instrumentation: Ventilation, cooling and heating wind speed, temperature and humidity, rain gauge, carbon dioxide enrichment measurement and control	**(6)**

References:

1. Process Control Instrumentation Technology, Johnson C. D., 7th Edition, Pearson Education, New Delhi, 2003.
2. Industrial Instrumentation, D. Patranabis, 3rd edition, Tata McGraw Hill.
3. Process Instrumentation, and Control Handbook, Considine D. M ., 3rd edition, McGraw Hill International publications, New Delhi.

BSH 305: Communication Skill-II

Teaching Scheme
Theory: 02Hours/Week

Examination Scheme
Term Work: 50 Marks

Prerequisite:

1. **Basic Knowledge of Soft Skills**
2. **Good understanding of English**

Objectives:

1. To imbibe leadership skills
2. To develop interpersonal Skills
3. To introduce corporate etiquettes
4. To imbibe team skills

CONTENTS

Unit 1: **Understanding self and Goal Setting** **(5)**

- Self-Assessment: Understanding Self Core Competency (SWOT/SWOC)
- Long term and short-term Goal Setting
- Execution Skills

Unit 2: **Interpersonal Skills** **(6)**

- Interpersonal Communication
- Conflict Management
- Problem Solving
- Decision Making
- Persuasion and Influence

Unit 3: **Group Dynamics and Team Building** **(4)**

- Group Vs Team
- Team Building
- Team Work
- Developing Leadership Skills

Unit 4: **Corporate Etiquette** **(5)**

- Clothing Etiquette, Personal hygiene and grooming
- Time Management
- Influencing Skills (Impression)
- Balancing personal and professional Life
- Ethics, Values and Laws

Text Book:

The Ace of Soft Skills (Gopalaswamy Ramesh) Pearson Publication

Reference Books:

1. **Execution** : Ram Charan
(Publisher: Crown Business; 1 edition (June 15, 2002)
Language: EnglishISBN-10: 0609610570ISBN-13: 978-0609610572)

2**. Laws of Teamwork** : John C Maxwell

3. **Master of Business Etiquette** : Cyrus Gonda
(Author: Cyrus Gonda, Publisher EMBASSY BOOKS, 2017, ISBN 9385492721, 9789385492723)

4. **Goals** :
(Author: Brain Tracy ISBN: 1-57675-235-6Published by Berrett-Koehler Publishers, Inc)

5. **Interpersonal Skills at work** :
(Author: John Hayes Second Edition: Routledge)

6. **People Smart** :
(Author: Freda Hansburgby Berrett-Koehler Publishers, Inc)

Term Work Assessment (50 marks):

The term work shall consist of internal online examination of 50 Marks, conducted at institute level. The marks of the examination shall be forwarded to the University.

ICE 321: Laboratory I: Signals and Systems

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

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

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

ICE 322: Laboratory II: Control System Components

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term Work: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

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.

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

ICE 323: Laboratory III: Advanced Microprocessor and Microcontroller

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

1. 8086 ALP for addition/subtraction of two sixteen bit numbers
2. 8086 ALP for multiplication/division of two sixteen bit numbers
3. 8086 ALP to find odd/even numbers of a given sequence
4. 8086 ALP to find positive/negative numbers of a given sequence
5. 8086 ALP for block data transfer
6. 8051 ALP for addition/subtraction of two eight/sixteen bit numbers
7. 8051 ALP for multiplication/division of two eight/sixteen bit numbers
8. 8051 ALP to find odd/even numbers of a given sequence
9. 8051 ALP to find positive/negative numbers of a given sequence
10. 8051 ALP for block data transfer

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

ICE 324: Laboratory IV: Process Instrumentation

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

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.)

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

PART-2

ICE 351: Digital Signal and Image Processing

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

Examination Scheme
Paper: 80 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.

ICE 352: Power Electronics

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

Examination Scheme
Paper: 80 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)**

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.

ICE 353: Control Engineering

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

Examination Scheme
Paper: 80 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

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ICE 354: Distributed Control System

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

Examination Scheme
Paper: 80 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)**

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.

ICE 355: Elective-I
(1) ICE 355: Power Plant Instrumentation

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

Examination Scheme
Paper: 80 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. DelhiI – 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.

(2) ICE 355:Robotics

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

Examination Scheme
Paper: 80 Marks

1 Basic Concepts: **(4)**
Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov's laws of robotics, dynamic stabilization of robots.

2 Power Sources: **(8)**
Hydraulic, pneumatic and electric drives, determination of HP of motor and gearing ratio, variable speed arrangements, path determination, micro machines in robotics.

3 Manipulators, Actuators and Grippers: **(8)**
Construction of manipulators - manipulator dynamics and force control, electronic and pneumatic manipulator control circuits, end effectors, various types of grippers - design considerations.

4 Kinematics and Path Planning: **(8)**
Solution of inverse kinematics problem, multiple solution jacobian work envelop, hill climbing techniques, introduction to robot programming languages.

5 Sensors and Intelligent Robots: **(8)**
Introduction to robotic sensors, vision systems, Range detectors, assembly aid devices, force and torque sensors, machine vision, ranging, laser, acoustic, magnetic, fiber optic and tactile sensors.

6 Case Studies: **(4)**
Multiple robots, machine interface, robots in manufacturing and non- manufacturing applications, robot cell design, selection of robot.

Text/Reference Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw- Hill, Singapore, 1996.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.

(3) ICE 355: Analytical Instrumentation

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

Examination Scheme
Paper: 80 Marks

1	Introduction to chemical instrumental analysis, advantages over classical methods, classification: Spectral, electro analytical and separate methods, Interaction of radiation with matter, Laws of photometry (Beer and Lambert's Law), Deviation from Beer's law, working of filters, Prism and grating monochromators, concept of design of analytical instrument.	**(4)**
2	Colorimeters, online colorimeter for process applications, turbidity meter, UV-visible spectrometers and its types with its optical system design, IR spectrometers, X-Ray, spectroscopy.	**(8)**
3	Emission Spectra, Quantitive measurements, Flame Photometer and its applications, concept of design atomic absorption spectrometer, spectrum interpretation, interferences, applications of atomic absorption spectrophotometer.	**(8)**
4	Classification of Chromatographic methods, gas chromatography, process gas Chromatograph, Liquid Chromatography, high performance liquid chromatography (HPLC).	**(8)**
5	Different types of gas analyzers for measurement of oxygen, NO2, Ammonia, carbon dioxide and hydrocarbons, real world applications : environmental monitoring system, real time gas leakage monitoring working principle and applications of laboratory instruments : centrifuge, oven, stirrers.	**(8)**
6	Working principle, analyzers and detector types of mass spectrometer, applications	**(4)**

Text/Reference Books:

1. Willard, Merritt, John AurieDean, "Instrumental Methods of Analysis", CBS Publishers & Distributors, New Delhi, Seventh ed., 1988.
2. R. S. Khandpur, "Handbook of Analytical Instruments", Tata McGraw-Hill Publications, Second ed., 2006.

ICE 371: Laboratory V: Digital Signal and Image Processing

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 Experiments/Programs based on the syllabus, which may include the following.

1. Program for DFT
2. Program for Circular Convolution
3. Program for IIR Filter Design
4. Program for FIR Filter Design
5. Program for Chebyshev type-I Filter
6. Program for Chebyshev type-II Filter
7. Program for Image Enhancement
8. Program for Arithmetic operations on Image
9. Program for Histogram of Image
10. Program for Histogram Equalization
11. Program for DCTF of Image

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

ICE 372: Laboratory VI: Power Electronics

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
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.

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

ICE 373: Laboratory VII: Control Engineering

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 Experiments/Programs based on the syllabus, which may include the following.

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.

ICE 374: Laboratory VIII: Distributed Control System

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term Work: 50 Marks

List of Experiments/Programs
The Students are expected to perform a set of 8 experiments based on the syllabus, which may include the following.

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.

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

ICE 375: Seminar

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term Work : 50 Marks

Individual student has to present seminar on the recent/current topic and also has to submit a report of the same.