NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Syllabus for

Final Year Instrumentation Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER – VII and VIII

W.E.F 2015 – 2016

PROGRAM EDUCATIONAL OBJECTIVES. (PEOs)

The Board of Studies in Instrumentation Engineering of North Maharashtra University, Jalgaon (India) has defined set of program educational objectives. The Program Educational Objectives of Instrumentation Engineering are designed to provide graduates with:

PEO1: Professional Knowledge: Graduates shall acquire the fundamental and advanced knowledge in Instrumentation Engineering subjects along with additional knowledge on other subjects such as Mathematics, Inter-disciplinary, Engineering, Management and Economics to solve basic and complex engineering problems. Graduates will be able to design system within realistic constraints for sustainable developments.

PEO2: Professional Employment: Graduates will have a successful career in Instrumentation Engineering. Graduates will succeed in getting the entry-level engineering positions as trainee engineer, project engineer, erection and commissioning engineer, automation engineer in process industries, Government Organizations at regional and national levels and as an Entrepreneur.

PEO3: Higher Studies & Life Long Learning: Graduates may pursue their professional development through self-learning, advanced degree and continue life-long learning. Graduates will be able to use software and modern engineering tools.

PEO4: Social Engineering: Graduates will aware of social responsibility, ethical values, safety standard, economical and environmental issues so that they serve the society better.

PROGRAM OUTCOMES (POs)

a. An ability to apply knowledge of mathematics, science, and engineering.

b. An ability to design and conduct experiments, as well as to analyze and interpret data.

c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. An ability to function on multidisciplinary teams.

e. An ability to identify, formulates, and solves engineering problems.

f. An understanding of professional and ethical responsibility.

g. An ability to communicate effectively.

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

i. Recognition of the need for, and an ability to engage in life-long learning.

j. Knowledge of contemporary issues.

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

l. An ability to work professionally in both software and hardware system areas including the design and realization of such systems.

North Maharashtra University, Jalgaon

Syllabus Structure For Final Year Instrumentation Engineering w.e.f year 2015-16

Semester –VII

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme				Total	Credits
							Theory		Practical			
			Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	ISE	ESE	ICA	ESE		
	Instrumentation In Unit Operations (TH)	D	3	_	_	3	20	80	_	_	100	3
	Biomedical Instrumentation(TH)	D	3	_	_	3	20	80	_	_	100	3
	Interdisciplinary Elective (TH)	E	3	_	_	3	20	80	_	_	100	3
	Elective – I (TH)	E	3	_	_	3	20	80	_	_	100	3
	Digital Image Processing (TH)	D	3	_	_	3	20	80	_	_	100	3
	Biomedical Instrumentation (LAB)	D	_	_	2	2	_	_	25	25 (PR)	50	1
	Digital Image Processing (LAB)	D	_	_	2	2	_	_	25	25 (PR)	50	1
	Elective – I (LAB)#	E	_	_	2	2	_	_	25	25 (OR)	50	1
	Project – I (LAB)	D	_	_	2	2	_	_	25	25 (OR)	50	2
	Seminar – II	D	_	_	2	2	_	_	25	_	25	2
	Industrial Visit	D	_	_	_	_	_	_	25	_	25	1
	Total		**15**	**0**	**10**	**25**	**100**	**400**	**150**	**100**	**750**	**23**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

	Interdisciplinary Elective		Elective - I
1	Programmable Logic Controller & Distributed Control System	1	Industrial Drives and Control
2	Virtual Instrumentation and LABVIEW	2	Environmental Instrumentation
3		3	Fiber Optics & Laser Instrumentation
		4	Neural Network & Fuzzy Logic Instrumentation

- # lab for Elective – I (LAB)
- Interdisciplinary Elective shall be offered by the department to the students of other departments. Students from one department can not register for Interdisciplinary Elective of the same department.
- At least 15 students should register for offering any elective.

North Maharashtra University, Jalgaon

Syllabus Structure For Final Year Instrumentation Engineering w.e.f year 2015-16

Semester –VIII

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme				Total	Credits
							Theory		Practical			
			Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	ISE	ESE	ICA	ESE		
	Instrumentation System Design (TH)	D	3	_	_	3	20	80	_	_	100	3
	Industrial Automation (TH)	D	3	_	_	3	20	80	_	_	100	3
	Elective – II (TH)	E	3	_	_	3	20	80	_	_	100	3
	Elective – III (TH)	E	3	_	_	3	20	80	_	_	100	3
	Instrumentation System Design (LAB)	D	_	_	2	2	_	_	25	25 (PR)	50	1
	Industrial Automation (LAB)	D	_	_	2	2	_	_	25	25 (PR)	50	1
	Elective – II (LAB)#	E	_	_	2	2	_	_	25	25 (OR)	50	1
	Industrial Lecture	C	_	_	1*	1	_	_	50	_	50	2
	Project – II	D	_	_	4	4	_	_	75	75(OR)	150	6
	Total		**12**	**0**	**11**	**23**	**80**	**320**	**200**	**150**	**750**	**23**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

	Elective-II		**Elective - III**
1	Power Plant Instrumentation	1	Optimal & Adaptive Control
2	Computer Network	2	Nano Instrumentation
3	Agricultural Instrumentation	3	Automotive Instrumentation
4	Soft Computing	4	Embedded Systems

- # lab for Elective – II (LAB)
- * Lectures to be delivered by experts from the industry in alternate weeks. Next week group discussion on the lecture delivered.
- At least 15 students should register for offering any elective.

Course Title	Short Title	Course Code
Instrumentation in Unit Operations	**IUP**	

Course Description:

This course includes introduction to the Units Operations and Instrumentation System. This course is designed to introduce the students to the basic principles of design of controllers for the processes like evaporation, distillation, heat exchangers. It includes study of the material handling equipments and mechanical separation methods. This course provides instruction in the theory and application of Unit Operations. The course explores the knowledge and understanding the structure of unit operations present in industry. Course gives platform to learn the qualitative functions of the system components (sensors, actuators, controller design, equipment design) .

Lectures	**Hours/Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	03	**15**	**42**	**03**

Prerequisite Course(s): Chemical Processes, Laws of Thermodynamics, Control Systems, Controllers etc.

Course Objectives: Students will able to **k**now the important components of chemical engineering, concepts of unit operations and unit processes, and current scenario of chemical & various process industries.

Course Outcome

Upon completion of course students will be able to:

1. Understanding of chemical engineering and its relation to other disciplines.
2. List chemical processes, units, and the corresponding equipments.
3. Make material balances and energy balance on unit operations and processes.
4. Understanding of the degrees of freedom analysis and its significance.
5. Get knowledge of basic principles of fluid mechanics
6. Analyze fluid flow problems with the application of the momentum and energy equations
7. Analyze pipe flows as well as fluid machinery for mixing processes
8. Understand fluid particle systems and equipment
9. Select suitable size reduction equipment, solid-solid separation method and conveying system

Instrumentation in Unit Operations

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hour

Unit-I **9 Hours, 16 Marks**

Introduction: - Concept of unit operations & unit processes, material balance and energy balance.

Evaporation: - Liquid characteristics, types of evaporators, Methods of Feeding, operation of single effect and multi effect evaporator, capacity & economy of multiple effect evaporation, Vapour recompression, Operation of mechanical and thermal Recompression, Instrumentation and control for this process.

Drying: - Classification of dryers, Principle & operations, Drying equipments, Instrumentation for this process.

Unit -II **9 Hours, 16 Marks**

Distillation:- Equipment set up, Operation of flash Distillation, Batch Distillation, Continuous Distillation, Fractionating Column; slue plate arrangement, Rectification and stripping, Instrumentation and control for this process.

Leaching and Extraction: - Principles, Various types of equipments for this process.

Unit-III **8 Hours, 16 Marks**

Material Handling Equipments: - Transport Equipments, Positioning Equipments, Unit load formation Equipment, Storage equipment, Identification & control equipment.

Size Reduction:-Principle of commutation Equipments, Classification and operation of crushers & grinders.

Unit -IV **8 Hours, 16 Marks**

Crystallization: - Definition, Magma, Super-saturation, formation of Crystal, Equipment classification& operation. Instrumentation & control for this process.

Mechanical separation: Screening, Filtration **–** Mechanisms of filtration, Types of Industrial filters- Rotary filter, filter press, Centrifuges, cyclones, Bag filter, electrostatic precipitators and Centrifuge separator.

Unit -V **8 Hours, 16 Marks**

Heat Exchangers:-Theory, Types of heat exchanger, temperature pattern in heat exchanger, condensers, Boilers. Application of above Unit operations in Paper, Cement, Fertilizer, Petrochemical and sugar industry.

Books: -

1. McCabe Smith, 'Unit Operation of Chemical Engineering', 5th Edition, McGraw Hill.
2. Perry, 'Chemical Engineers Handbook', 6th Edition, McGraw Hill int. Student ed. 1984.
3. Felder, Rotsseau, Herriot, 'Elementary principles of Chemical Processes', Wiley 1978
4. W.F. Stoeker, 'Design of Thermal System', 3rd Edition McGraw Hill int. ed. 1989.
5. M. Gopalrao& M. Sitting , 'Outline of Chemical Technology', 2nd edition east west 1973.
6. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Biomedical Instrumentation	**BI**	

Course Description:

This course includes introduction to the Biomedical Instrumentation and Measurement. This course is designed to introduce the students to the basic principles and applications of sensors, medical oscilloscopes, analog and digital instruments. It includes basic knowledge of heart, brain and muscular system and different types of signals. This course provides instruction in the theory and application of biomedical instruments. The course explores the knowledge and understanding the canonical structure of biomedical instrumentation systems. Course gives platform to learn the qualitative functions of the four primary system components (sensors, actuators, electronics interface, computation unit) .

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lectures	**03**	**15**	**42**	**03**

Prerequisite Course(s) : Human Anatomy and Physiology, Analytical Instrumentation, Electronic Instrumentation, Signal Processing, Sensors and Transducers, Human Diseases

Course Objectives:

Course objectives are the study of different types of electrodes used in bio-potential recording. To understand how to measure various biochemical and nonelectrical parameters of human system

Course Outcomes:

Upon completion of course students will be able to:

1. Understands structure of human body
2. Understands use of Biomedical Instruments
3. Understands Transducers for biomedical instrumentation
4. To evolve an instrumentation system for diagnosis, therapy, supplementation of body functions.
5. Function in interdisciplinary team to solve engineering impact on human pathology .
6. Serve as engineer in medical field for safety of human being.

Biomedical Instrumentation

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit I: **09 Hours, 16 Marks**

Introduction to gross anatomy of human body, major physiological systems, their structure and function. Cell structure, basic cell functions, Origin of bio potentials, electrical activity of cells, Introduction to biomedical instruments, classification and justification

Unit II: **09 Hours, 16 Marks**

Transducers for biomedical instrumentation and selection, biomedical electrodes Cardiological systems: Structure of heart, rhythamicity, cardiac cycle, heart sounds, cardiac output, blood pressure measurement, direct, indirect, Spygmomanometer, Digital B.P.Cardio vascular instrumentation: ECG electrodes, & leads, Cinthoven triangle, ECG quantification, PC based ECG analysis.

Unit III : **08 Hours, 16 Marks**

Pacemakers, Defibrillators, Biotelemetry, bedside monitors, ICU, Heart Lang machine, Phonocardio graph, plentysmograph, Artificial Kidney, Blood cell counters,

Unit IV: **08 Hours, 16 Marks**

Central Nervous system: The Brain, Receptors, sensory pathway and motor systems, Evoked potential, Electron rephalogram, EEG analysis, EMG. Mechanics of breathing O2/CO2 transport between lungs and tissue cells, Spirometer, Artificial respiration.

Unit V :- **08 Hours, 16 Marks**

Imaging system: X-ray, CT Scan, Ultrasonography, MRI, Endoscopy.

Electrical safety: Significance of electrical danger, Physiological effects of electrical current, Ground shock hazard, and methods of accident prevention.

Reference Books:-

1. R S Khandpur, “Handbook of Biomedical Instrumentation, ”TMH
2. Cromwell , “Biomedical Instrumentation and Measurement, “PHI
3. IS G Khalekar, “Introduction to Biomedical instrumentation,”
4. Handbook of Biomedical Instrumentation, “Webster”.
5. http://nptel.iitm.ac.in

Course Title Short Title Course Code

Interdisciplinary Elective

i. Programmable Logic Controller & Distributed Control System

(Short Title PLC & DCS)

Course Description:

This course describes PLC , DCS & SCADA based Industrial Automation system which will improve the knowledge of the students about industrial processes using automation. The course will cover SCADA & PLC systems in terms of their architecture, their interface to the process hardware, the functionality and the application development facilities. Also provide an industrial SCADA & PLC system is used for the development of the controls of machinery.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lectures	**03**	**15**	**42**	**03**

Prerequisite Course(s): Knowledge of c-programming, Industrial organization and management subject of third year, industrial drives and control subject of final year.

Course Objectives:

The objectives of subject are that students will able to understand the role of industrial automation for different processes based on PLC system and its requirement. It also provide basic operation of programmable logic control and its function. Students will learn the input-output devices for the PLC, its operation, its selection according to application and its interfacing. It explores the knowledge of different configuration of PLC, its programming techniques for various application, and it's interfacing with industrial machineries. It also help to understand the application in different industries like power sector, in pharmaceuticals, in automobile industry etc and its installation.

Course Outcomes:

Upon successful completion this course a students will be to

1. Apply the knowledge of automation in machine control.
2. Design and conduct practical in realistic constrain on motors such that it is applicable in manufacturing, testing and maintenance field.
3. Design the automation system for fast and value added quality product for economical growth through technological development.
4. Solve engineering solution for fast growing industrial sector with reliable atomized system using PLC , DCS and SCADA system.
5. Discharge professional duty in multidisciplinary teams of installation ,maintenance and operation with séance of safety standards.
6. Do higher study in field of automation and able use updated software and tools.

Interdisciplinary Elective

i. Programmable Logic Controller & Distributed Control System

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit-I **09 Hours, 16 Marks**

Plant Automation and Control Systems Strategy, Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Performance criteria and Safety Systems.

Unit II: **09 Hours, 16 Marks**

Applications of PLC's, Specifications of advanced PLC's, Input speed modules, modular controller, High speed counter, Remote input-output scanner, Communication module, limit switches, scan time, watchdog timer, PLC programmer and its features, programming instructions, input output timer counter, bit comparison FIFO LIFO branch instructions etc. System configuration hardware, system sizing and selection, wiring diagram, PLC installation, Interfacing to PC, Multi programming languages like ladder diagram, Structured text, Sequential flow chart, Instruction language, Functional block diagram, State diagrams etc Development of ladder diagram, for Industrial applications.

Unit III: **08 Hours, 16 Marks**

DCS- Basic Packages Introduction, analog control, direct digital control, distributed process control, DCS configuration with associated accessories, control console equipment, control unit (Relay Rack mounted equipments), local control units, attributes of DCS & DCS Flow sheet symbols. DCS System Integration I/O hardware stations, Set-point station control, Supervisory Computer Tasks & configurations, system integration with PLCs and computers, Human Machine Interface for process monitoring and control, Introduction to expert systems, and Statistical Process Controls.

Unit IV: **08 Hours, 16 Marks**

Instrumentation Standard Protocols, HART Protocol, frame structure, programming, implementation examples, Benefits, Introduction, Advantages and Limitations of Field bus, FDS configuration, Comparison with other field bus standards including Device net, Profibus, Control net, CAN, Industrial Ethernet, MAP and TOP.

Unit -V: - **08 Hours, 16 Marks**

Industrial applications of PLC, SCADA, DCS and open systems for following plants; Cement plant, Thermal power plant, Steel Plant, Glass manufacturing plant, Paper and Pulp plant.

Reference books

1. Bela G, LIPTAK "Instruments Engineers Handbook" Vol-II, Process Control 3rd Edition 1995," Chilton
2. Popovicand Bhatkar , "Distributed Computer Control for Industrial Automation, Dekker.
3. KrishanKant , "Computer-based Industrial Controls" PHI.
4. Applications of computers in Process Control, "Considine".
5. T.HTsai, "Modern Control Techniques for the Process Industries"
6. Lane", Mareeet Dekkar, N.Y 1986.
7. Iserman, "Digital Control System,"
8. J.D.Otter, " Programmable Logic Controller," (PHI).
9. Huges, "Industrial Programmable controller, (ISA).
10. http://nptel.iitm.ac.in

Course Title Short Title Course Code

Interdisciplinary Elective

i. Virtual Instrumentation and LABVIEW

LabVIEW gives you the chance to explore the LabVIEW environment, dataflow programming, and common LabVIEW development techniques in a hands-on format. Learn to develop data acquisition, instrument control, data-logging, and measurement analysis applications. At the end of the course you will be able to create applications using the state machine design pattern to acquire, process, display, and store real-world data.

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s) : Digital Circuits Design, Electronics Instrumentation, Measurement Fundamentals, Digital Signal Processing

Course Objectives:

1. It provides new concepts towards measurement and automation.
2. It imbibes knowledge about how to control an external measuring device by interfacing a computer.
3. To become competent in data acquisition and instrument control.

Course Outcomes:

Upon successful completion this course a students will be to

1. Acquire knowledge on how virtual instrumentation can be applied for data acquisition and instrument control.
2. Identify salient traits of a virtual instrument and incorporate these traits in their projects.
3. Experiment, analyze and document in the laboratory prototype measurement systems using a computer, plug-in DAQ interfaces and bench level instruments.
4. Understand front panels, block diagrams, icons, and connector panes, Create user interfaces with charts, graphs and buttons
5. Use the programming structures and data types that exist in LabVIEW, use various editing and debugging techniques
6. Create applications that use GPIB and serial port instruments, use the state machine design pattern in your applications

Interdisciplinary Elective

ii. Virtual Instrumentation and LABVIEW

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit-I **09 Hours, 16 Marks**

Review of Virtual Instrumentation, Historical perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming.

Unit-II **09 Hours, 16 Marks**

Programming Techniques, VIS & Sub VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string &file input.

Unit-III **08 Hours, 16 Marks**

Data Acquisition basics, ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware Installation.

Unit-IV **08 Hours, 16 Marks**

Common Instrument Interfaces for Current loop, Rs232C/Rs 485, GPIB, System basics, interface basics: USB, PCMCIA, VXI, SCXI, PXIetc, networking basics foroffice & industrial application VISA &IVI, image acquisition & processing, Motion Control.

Unit-V **08 Hours, 16 Marks**

Use of Analysis Tools, Fourier transforms, Power spectrum, Correlation methods, windowing & flittering. Application of VI: Application in Process Control Designing of equipments like Oscilloscope, Digital Millimeter using Lab view Software, Study of Data Acquisition & control using Lab view Virtual instrumentation for an Innovative Thermal Conductivity Apparatus to measure the Thermal Conductivity Apparatus- to measure the conductivity of non Newtonian fluids white they are subjected to sharing force.

Reference Books

1. Gary Johnson, “Labview Graphical Programming”, second edition, MC GrawHill, Newyork, 1997
2. Lisa K. Wells &Jettrey Travis, “Labview for Everyone”, Prentice Hall, New Jersey, 1997.
3. Sokoloff , “Basic Concepts of Labview 4”, Prentice Hall, New Jercy, 1998.
4. S. Gupta, J.P.Gupta, “PC interfacing for Data Acquisition & process control”, Second Edition, Instrument Society of America, 1994.

Course Title Short Title Course Code

Elective-I

i. Industrial Drives and Control IDC

Course Description:

The subject explores the knowledge of different industrial derives, load characteristic, factor effecting on selection of drives depending upon their electrical, mechanical characteristic. The subject also provides the knowledge of microprocessor based electric drives.

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s) : Knowledge Electrical Machines and Power Electronics .

Course Objectives:

The objective of subject is the Introduction to different types of drives and applications in various industries. To know the characteristics of various motors and loads. Gain the knowledge about operation of DC motor speed control using converters and choppers. To understand the modes of operation of a drive in various applications. To enable the students identify the need and choice for various drives. To acquire the knowledge of different speed control methods in AC motors using thyristors based control schemes. Identify the use of drives in industries using microprocessor.

Course outcome

After completion of course students will be able to:

1. Apply the knowledge of electrical engineering subjects in different application of industries like manufacturing, maintenance, operation and safety.
2. Understand different speed control methods in D.C and A.C motors using thyristors based control schemes.
3. Understand the characteristic of load and selection of derive in industrial sectors.
4. Conduct practical and analyze data for proper selection of derive in realistic constrain of load requirement.
5. Understand the impact of electrical characteristic of motor in electric traction system.
6. Discharge professional duties in industries with innovative ideas of operation and control of drives.
7. Do higher study in the field of modern derives and control.

Elective-I

i. Industrial Drives and Control

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit-I **09Hours, 16 Marks**

Introduction to motor drives: Classification, comparison of AC and DC drives, Basic elements, torque equations, component of load torque, multi-quadrant operation, equivalent drive parameters, components of power electronic drives criteria for selection of drive components match between the motor and the load, calculation of time and energy in transient conditions, characteristics of mechanical systems, stability consideration, thermal consideration, thermal model of motor for heating and cooling, match between the motor and power electronics converter, closed loop control of drives.

Unit- II **09Hours, 16 Marks**

DC drives System model, motor rating, motor mechanism dynamics, drive transfer function, effect of armature current waveform, torque pulsations, adjustable speed drives, chopper fed and 1 phase converter fed drives, effect of field weakening.

Unit- III **08Hours, 16 Marks**

Induction Motor drives Basic Principle of operation of 3 Phase motor, equivalent circuit, MMF space harmonics due to fundamental current, fundamental spatial MMF distributions due to time harmonics simulation, effect of time and space harmonics, speed control by varying stator frequency and voltage, impact of non-sinusoidal excitation on induction motors, variable square wave VSI drives, variable frequency CSI drives, line frequency variable voltage drives.

Unit -IV **08Hours, 16 Marks**

Induction Motor drives Review of induction motor equivalent circuit, effect of voltage, frequency and stator current on performance of the m/c, effect of harmonics, slip power recovery schemes-static Kramer drive and dynamic d.q model, small signal model, voltage and current fed scalar control, direct and indirect vector control, sensor less vector control, direct torque and flux control.

Unit –V **08Hours, 16 Marks**

Synchronous motor drives: Review of synchronous motor fundamental, equivalent circuit, dynamic d-q model, synchronous reluctance, sinusoidal and trapezoidal back emf permanent magnet motors, sinusoidal SPM machine drives, trapezoidal SPM machines drives, wound field machine drives, switched reluctance motor drives.

Closed loop control: Motor transfer function-P, PI and PID controllers, current control-Design procedure.

Books Reference:

1. V. Subramanyam , "Thyristerised Control of Electric Drives", Tata McGraw Hill, New Dehli.
2. Dubey, Joshi, Sinha, "Thyristor Power Control", Willey Eastern Publication.
3. M. Rashid, "Power Electronics Circuit Devices & Applications", Prentice Hall of India.
4. G. K. Dubey , "Fundamentals of Electrical Drives", Narosa Publishing House.
5. Mohammad A. El-Sarkawi, "Fundamentals of Electrical Drives" , vikas Publishing House.
6. Ned Mohan, " Electric Machines and Drives", Wiley India Pvt. Ltd.
7. http://nptel.iitm.ac.in

Course Title Short Title Course Code

Elective-I

ii. Environmental Instrumentation ENI

Lectures	Hours / Week	No. o f Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s): Environmental Engineering, Sensors and Transducers

Course Objectives:

1. To introduce the instrumentation methodologies for environment monitoring.
2. To deal with water quality monitoring and waste water treatment
3. To discuss the instrumentation required for air pollution monitoring.

Course outcomes:

Upon the completion of course students will be able to:

1. Apply knowledge of mathematics, science, and engineering for understanding environmental instrumentation.
2. Design ,conduct the practical and analyses data for realistic perdition of weather.
3. Design instrumentation systems for environment monitoring.
4. Develop algorithms for waste water treatment for safety and green environment.
5. Measure and analyse air quality for power generation and perdition of storm.
6. Use update software and tool in weather perdition for agriculture and navigation .

Elective-I

ii. Environmental Instrumentation

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures: 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit I: **09 Hours, 16 Marks**

Environmental Definition, Constituents, biochemical cycle, causes of pollution, types of pollution and their measurements, effects of pollution, Different sensors for measurement of pollution, difference between off-line Measurement and continuous monitoring.

Environmental Toxicology and Hazards, Common toxic agents, their analysis and safety measures, environmental regulations and standards.

Unit II: **09 Hours, 16 Marks**

Review of standard methods of pollution analysis, Sampling Operations, Devices and techniques as related to environmental engineering. Air Pollution Analysis: Analysis of Aerosols and Monitoring of gaseous pollutants like SO2, H2S, NO-Nox, CO-CO2, Ozone, NH3 and organic gases, Vapor analysis, Monitoring of suspended particulate matter and trace metal pollutants.

Unit III: **08 Hours, 16 Marks**

Water Pollution Analysis Physical Examination – color, conductivity, temperature, odor, turbidity, hardness. Chemical Characterization – Ca 2+, Mg2+, Na+, Cl-,SO4 2+, HCO3-, Al3+, Ba2+Boron, F-, NO2-, PO4 3-, Fe3+ Mn2-, SiO2 2-,Biological Investigations – DO, BOD, bacteriological examination, and types of water quality monitoring instruments (pH meters, conductivity meters etc.)

Effluent Analysis: Physical Methods of characterization: density, viscosity, temperature, conductivity, turbidity, volatile, and dissolved solids, oil and immiscible liquids, color, odor, radioactivity, and analysis of organic pollutants.

BOD, COD, TOC, Specific analysis of Organic pollutants, Analysis of metal pollutants, Analysis of anion and dissolved gases dissolved oxygen, pH, dissolved chlorides, suspended solids, nitrogen, sludge index

Unit IV: **08 Hours, 16 Marks**

Soil pollution and Pesticide Analysis: Analysis of Micronutrients, trace element pesticides, Chromatographic Characterization, Polarographic and Spectroscope Analysis of pesticides.

a. Noise pollution and its Measurement: Units, Devices and maps Noise Control System.
b. Radiation pollution and its Measurement and Control.

Unit V : **08 Hours, 16 Marks**

Instrumentation Setup for different types of pollution control like waste water treatment, HVAC Control etc.

Environmental testing, Dry heat, Dry cold, Damp heat, Salt Spray, Dust, Altitude bump, Vibration Drop/Topple, free fall and study of ISO 14001.

References:

1. S.M. Khopkar, "Environmental Pollution Analysis", 1st Ed. Wiley eastern 1993
2. S. M. Khopkar ,, "Basic Concepts of Analysis Chemistry"
3. Peary H.S. and other , "Environmental Engg.,".
4. Campbell, "Sensor System for Environmental Monitoring"
5. J. A. Nathanson, "Basic Environmental technology (Ed. 1997)".
6. Neal K. Ustler, "Environmental tech series, V, I, II, III, IV"

Course Title	Short Title	Course Code
Elective-I	**FOLI**	

iii. Fiber Optics & Laser Instrumentation

Course Description: To expose the students to the basic concepts of optical fibres and their properties. To provide adequate knowledge about the Industrial applications of optical fibres in instrumentation

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s):

Course Objectives:

To introduce the basic concepts of Optical Fibers and Lasers and their applications in the field of Instrumentation.

Course Outcomes:

- Use Optical fibers for measurement
- Apply LASER in Instrumentation and Biomedical applications.

Elective-I

iii. Fiber Optics & Laser Instrumentation

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit –I **09 Hours, 16 Marks**

Principles of light propagation through a fiber, Different types of fibers and their properties, Fiber materials and their characteristics- Transmission characteristics of fibers, absorption losses, scattering losses, Dispersion, Measurement on optical fibers, Optical sources, Optical detectors.

Unit –II **09 Hours, 16 Marks**

Fiber optic instrumentation system, Fiber optic sensors Different types of modulators, Applications in instrumentation- Inter-ferometric method of measurement of length, Measurement of pressure, temperature, current, voltage, liquid level and strain.

Unit –III **08 Hours, 16 Marks**

Fundamental characteristics of laser, three level and four level lasers, properties of lasers, laser modes- resonator configuration, Q switching and mode locking, cavity dumping, types of Laser, gas laser, solid laser, liquid laser, semi conductor laser.

Unit –IV **08 Hours, 16 Marks**

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect , Laser application in Spatial Frequency Filtering ,Holography -Basic principle; methods; Holographic interferometry and applications; Holography, for non-destructive testing- Holographic components.

Unit –V **08 Hours, 16 Marks**

Applications in Material processing, Laser Welding, Hole drilling, Laser Cutting, Laser Tracking, Medical applications of lasers; laser and tissue interaction. Laser instruments for surgery.

Reference Books:

1 I. John and Harry, “Industrial lasers and their Applications”, McGraw Hill,
2 John F Ready, “Industrial Applications of Lasers” Academic press, 1978.
3 John Crisp, “Introduction to Fibre Optics”, an imprint of Elsevier Science, 1996.
4 Jasprit Singh, “Semi Conductor Optoelectronics”, McGraw Hill, 1995.
5. Jeff Hecht, “Understanding Fiber Optics”, 5th edition, Prentice Hall publishers
6 A. Selvarajan, S.Kar and T.Srinivas , “Optical Fiber Communication Principles and Systems”,TMH

Course Title	Short Title	Course Code
Elective-I	**NNFLI**	

iv. Neural Network & Fuzzy Logic Instrumentation

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s) :

Nil

Course Objectives:

To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.

Course Outcomes:

1. To expose the students to the concepts of feed forward neural networks.
2. To provide adequate knowledge about feedback neural networks.
3. To teach about the concept of fuzziness involved in various systems.
4. To provide adequate knowledge about fuzzy set theory.
5. To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic
6. and to design the fuzzy control using genetic algorithm.
7. To provide adequate knowledge of application of fuzzy logic control to real time systems.

Elective-I
iv. Neural Network & Fuzzy Logic Instrumentation
(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit -I: **09Hrs, 16 Marks**

Artificial neural systems, Preliminaries, fundamental concepts & models of artificial system, neural network learning rules, Hebbian, perceptron, delta Widrow-Hofflearning rules. Single layer perception classification: Classification model, features &decision regions training & classification using discrete perception, algorithm &examples, single layer continuous perception networks for linear separable classification.

Unit -II: **09Hrs, 16 Marks**

Multilayer feedback work networks, Generalized delta learning rule, feed-forwar drecall & back propagation training learning factors. Single layer feedback networks: basic concepts of dynamical systems mathematical of discrete time & gradient typeHopfield networks, transient response of continuous time solution optimization problems..

Unit- III: **08Hrs, 16 Marks**

Neural network in control system, Neuro-control approaches, training algorithm evaluated training algorithms, through simulation, self tuningneuro-control scheme, self tuning PID controller, Application of neuro-control for process control

Unit -IV: **08Hrs, 16 Marks**

Introduction of fuzzy control, Introduction fuzzy control form an intuition perspective, mathematical of fuzzy control fuzzy sets, fuzzy relations, approximate resolving representing a set of rules, Non linear fuzzy control: The control problem, FKBC as non linear transfer element PID& duding mode type FKBC some typical application of fuzzy based control systems.

Unit -V : **08Hrs, 16 Marks**

Fuzzy knowledge based controller FKBC design parameters Structure of FKBC fuzzification and Defuzzification module, rule based choice of variable and contentsof rules, derivation of data based choice of membership function and scaling factors, choice of fuzzification and Defuzzification procedure. Fuzzy-Neuro and Neuro-FuzzyControllers.

Reference Books:

1. J.M.Zurad, "Introduction of artificial neural systems," Jaico publicationHouse 1997
2. S.Iiaykin, "Neural Networks: Comprehensive Foundation," McMillianCollege Publishing company inc. 1994
3. S.Omatu, M.Kiialid, R.Yusof , "Neuro Control and its Application, " SpringVerlag London Ltd. 1996.
4. D.Driankov, H. Hellendoorn Andm Reinfrank, "An Introduction to Fuzzy Control," Narosa Publication House, 2nd reprint 1997.
5. Hagan, Demuth Deak, "Neural Network Design", Thomson Learning.
6. Neuro-fuzzy and soft computing, PHI publication
7. John Yen , "Fuzzy logic: Intelligence control and Information," Pearsonpublication.

Course Title	Short Title	Course Code
Digital Image Processing	**DIP**	

Course Description:
This course introduces the basic theories and methodologies of digital image processing. The topic include intensely transformations for image enhancement, two dimensional discrete Fourier transform, spatial and frequency domain linear image filtering. The course make extensive use of MATLAB as an analysis, design and visualization tool.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lectures	**03**	**15**	**42**	**03**

Prerequisite Course(s) : Digital Signal Processing, Signals and Systems

Course Objectives:
The fundamentals of digital image processing and algorithms that are used. Useful skill base that would allow them to carry out further study should they be interested and to work in the field. The students are expected to develop a foundation that can be used as the basis for further study and research in this field. The syllabus gives great emphasis on basic principles as well as more advanced techniques for image enhancement, segmentation, morphological operations etc.

Course Outcomes:
Upon the completion of course the students will be able to:

1. Acquire the fundamental concepts of a digital image processing system
2. Identify and exploit analogies between the mathematical tools used for 1D and 2D signal analysis and processing
3. Analyze 2D signals in the frequency domain through the Fourier transform
4. Design and implement with Mat lab algorithms for digital image processing operations such as histogram equalization, enhancement, restoration, filtering, and denoising.

Digital Image Processing
(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE)Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit -I: **09 Hrs, 16 Marks**

Digital Image representation, steps in Image processing, Elements of IP system, Frame Grabber, Digital camera, Elements of visual perception, Image model, Sample and Quantization, Basic relationship between pixels, Image Geometry, 2D linear convolution, 2D Circular Convolution, 2D Correlation.

Unit -II: - **09 Hrs, 16 Marks**

Image Transforms, Introduction to Fourier Transform, 2DDiscrete Fourier Transform, Properties of 2-D Discrete Fourier Transform, FFT, Walsh transform, Hadamard Transform, Discrete Cosine transform, Harrtrans form, Slant Transform, Hough Transform, Radon Transform, Curvelet Transform.

Unit- III: - **08 Hrs, 16 Marks**

Image Enhancement methods by Spatial and Frequency domain methods, point processing, Spatial filtering, Color Image processing, Image Restoration, Degradation model, Digitalization of circulant and block circulant matrices, Algebraic approach, inverse filtering, Least Mean Square filter, constrained Least square restoration, Restoration in spatial domain, geometric Transformation

Unit -IV: - **08 Hrs, 16 Marks**

Image Compression by Redundancies, Image compression models, Elements of Information theory, Error-Free compression, Lossy compression, compressions tandards: JPEG & MPEG. Image Segmentation Detection of Discontinuities, Edge linking and Boundary detection, Thresholding, Region oriented segmentation, use of motion in segmentation..

Unit -V :- **08 Hrs, 16 Marks**

Representation and Description Representation schemes, Boundary descriptors, Regional descriptors, Morphology, Applications of Image Processing in Instrumentation and Control.

Reference Books:

1. R.C.Gonzalez and R.E.Woods, "Digital Image Processing," Addison-WesleyLongman,Inc, 1999.
2. A.K.Jain, "Digital Image Processing" Prentice Hall India.
3. M.Sonka, V.Hlavac, andR.Boyle, " Image Processing, Analysis and Machine Vision," Thomson Asia pvt. Ltd, 1999.
4. Jayaraman,Esakkirajan, Veerakumar , "Digital Image Processing," McGraw Hill.
5. S. Shridhar , "Digital Image Processing," Oxford University Press.

Course Title	Short Title	Course Code
Biomedical Instrumentation LAB	**BI Lab**	

Lab Course Description:

This course includes introduction to the Biomedical Instrumentation and Measurement. This course is designed to introduce the students to the basic principles and applications of sensors, medical oscilloscopes, analog and digital instruments. It includes basic knowledge of heart, brain and muscular system and different types of signals. This course provides instruction in the theory and application of biomedical instruments. The course explores the knowledge and understanding the canonical structure of biomedical instrumentation systems. Course gives platform to learn the qualitative functions of the four primary system components (sensors, actuators, electronics interface, computation unit) .

Practical	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**15**	**28**	**1**

Prerequisite Course(s) : Human Anatomy and Physiology, Analytical Instrumentation, Electronic Instrumentation, Signal Processing, Sensors and Transducers, Human Diseases

Lab Course Objectives:

Course objectives are the study of different types of electrodes used in bio-potential recording. To understand how to measure various biochemical and nonelectrical parameters of human system

Lab Course Outcomes:

Upon completion of course students will be able to:

1. Understands structure of human body
2. Understands use of Biomedical Instruments
3. Understands Transducers for biomedical instrumentation
4. To evolve an instrumentation system for diagnosis, therapy, supplementation of body functions.
5. Function in interdisciplinary team to solve engineering impact on human pathology .
6. Serve as engineer in medical field for safety of human being.

Biomedical Instrumentation LAB

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Study of different biomedical transducers.
2. Study of cardiovascular systems
3. Study of ECG machine
4. Study of EEG simulator.
5. Study of EMG simulator.
6. Study of blood sugar meter.
7. Measurement of heartbeats using heart beat monitor.
8. Measurement of lung capacity using spirometer.
9. Demonstration of defibrillator.
10. Measurement of blood pressure by indirect method.
11. Electrical safety measures in hospitals.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student should be asked to perform any one practical. Evaluation will be based on paper work ,practical performance and oral in the practical examination.

Course Title	Short Title	Course Code
Digital Imaging Processing Lab	**DIP Lab**	

Lab Course Description:

Course Description:

This course introduces the basic theories and methodologies of digital image processing. The topic include intensely transformations for image enhancement, two dimensional discrete Fourier transform, spatial and frequency domain linear image filtering. The course make extensive use of MATLAB as an analysis, design and visualization tool.

Practical	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	**15**	**28**	**1**

Prerequisite Course(s) : Programming in MATLAB

Lab Course Objectives:

The fundamentals of digital image processing and algorithms that are used. Useful skill base that would allow them to carry out further study should they be interested and to work in the field. The students are expected to develop a foundation that can be used as the basis for further study and research in this field. The syllabus gives great emphasis on basic principles as well as more advanced techniques for image enhancement, segmentation, morphological operations etc.

Lab Course Outcomes:

Upon the completion of lab course students will be able to

1. Know and understand the basics and fundamentals of digital signal and image processing, such as digitization, sampling, quantization, and 2D-transforms
2. Operate on images using the processing techniques of smoothing, sharpening, enhancing, reconstructing geometrical alterations, filtering, restoration, segmentation, features extraction, compression, encoding and color /multichannel.
3. Manipulate images using the computer: reading, writing, printing, and operating on them.

Digital Imaging Processing Lab

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Study of IP Toolbox in MATLAB
2. Perform Arithmetic & Logical operations on Image
3. To study application of Histogram Equalization for image contrast improvement
4. To study application of Edge detection in IP for image identification
5. Application of FFT to perform operations on image like Convolution, Translation.
6. Application of FFT to perform operations on image like Rotation.
7. To Study application of Transform, Filtering by applying LPF& Mask for smooth imaging.
8. To Study application of Transform, Filtering by applying HPF& Mask for Image shaping.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student should be asked to perform any one practical. Evaluation will be based on paper work , practical performance and oral in the practical examination.

Course Title Short Title Course Code

Elective-I

i. Industrial Drives and Control Lab IDC Lab

Course Description:

The subject practical explore the knowledge of different industrial derives, load characteristic, factor effecting on selection of derives depend upon their electrical , mechanical characteristic and service duty. The practical also provides the knowledge of electric traction, ideal requirement of traction motor, operation and control. The practical provides brief knowledge of heat, ventilation and air conditioning system also.

Practical	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	15	28	1

Lab Course Objectives: The object is to select proper motor for given load characteristic. Selection of motor based on load characteristic, electrical, mechanical characteristic and service duty. The practical also provides the knowledge of electric drives, operation and control of electrical drives. The subject provides brief knowledge of four quadrant operation of drives.

Course outcome

After completion of course students will be able to:

1. Apply the knowledge of electrical engineering subjects in different application of industries like manufacturing, maintenance, operation and safety.
2. Understand different speed control methods in D.C and A.C motors using thyristors based control schemes.
3. Understand the characteristic of load and selection of derive in industrial sectors.
4. Conduct practical and analyze data for proper selection of derive in realistic constrain of load requirement.
5. Understand the impact of electrical characteristic of motor in electric traction system.
6. Discharge professional duties in industries with innovative ideas of operation and control of drives.
7. Do higher study in the field of modern derives and control.

Elective-I Lab

i. Industrial Drives and Control Lab

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments using MATLAB/ SIMULINK:

1. Transfer function of a DC Motor.
2. VSI fed three phase induction motor drive.
3. Three phase synchronous motor and drive.
4. Closed loop control of high frequency of DC – DC converters
5. Closed loop control of BLDC motors.
6. Closed loop control of Switched reluctance motors.
7. Vector control of three phase induction motors.
8. Vector control of three phase synchronous motors.
9. Closed loop control of PMSM.
10. Sensor less control of motors.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title Short Title Course Code

Elective-I

ii. Environmental Instrumentation Lab ENI Lab

.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s):

Lab Course Objectives:.

1. To introduce the instrumentation methodologies for environment monitoring.
2. To deal with water quality monitoring and waste water treatment

Lab Course Outcomes:

Upon the completion of course students will be able to:

1. Apply knowledge of mathematics, science, and engineering for understanding environmental instrumentation.
2. Design ,conduct the practical and analyses data for realistic perdition of weather.
3. Design instrumentation systems for environment monitoring.
4. Develop algorithms for waste water treatment for safety and green environment.
5. Measure and analyse air quality for power generation and perdition of storm.

Use update software and tool in weather perdition for agriculture and navigation .

Elective-I Lab
ii Environmental Instrumentation Lab
(Lab contents)

Semester-VII **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**
Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Turbidity of Water Sample by Nephlometric Method
2. PH Value of Water
3. Total Hardness of Water by EDTA Method
4. Suspended Solids in Water
5. Alkalinity of Water by Indicator Method
6. Coli form Bacteria by Multiple Tubes Fermentation
7. Chemical Oxygen Demand in Waste Water by Close Reflux Method
8. Bio Chemical Oxygen Demand in Waste Water
9. Dissolved Oxygen in Water by Azide Modification Method

Note: The minimum eight experiments are to be performed from the list of experiments.

Guide lines for ICA :
ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-
In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title	Short Title	Course Code
Elective-I	**FOLI Lab**	

iii. Fiber Optics & Laser Instrumentation Lab

Lab Course Description: To expose the students to the basic concepts of optical fibres and their properties. To provide adequate knowledge about the Industrial applications of optical fibres in instrumentation.

.

Practical	Hours / Week	No. o f Weeks	Total Hours	Semester Credits
	02	15	28	1

Lab Course Objectives:

To introduce the basic concepts of Optical Fibers and Lasers and their applications in the field of Instrumentation.

Lab Course outcomes:

- Use Optical fibers for measurement
- Apply Fibre optics and LASER in Instrumentation applications.

Elective-I Lab

iii Fiber Optics & Laser Instrumentation Lab

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. To study attenuation losses in optical fiber.
2. To study dispersion losses in optical fiber.
3. To study different splicing techniques.
4. To study OTDR.
5. To study characteristic curves of optical sources and detectors.
6. To measure numerical aperture of an optical fiber.
7. To study optical power meter.
8. Design of an optical fiber sensor.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title Short Title Course Code

Elective-I

iv. Neural Network & Fuzzy Logic Instrumentation Lab

Practical	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	15	28	1

Lab Course Objectives:

To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.

Lab Course Outcomes:

- To expose the students to the concepts of feed forward neural networks through programming.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To provide adequate knowledge about fuzzy set theory.

Elective-I Lab

iv Neural Network & Fuzzy Logic Instrumentation

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Write a program to generate the different Membership Functions of Fuzzy Logic.
2. Write a program for addition, difference, product and division of two membership functions of Fuzzy Logic Using.
3. Develop a Fuzzy Interface System for Restaurant Tipping.
4. To Perform the Fuzzy Logic Control for Two Inputs.
5. Write a program for Single Layer and Multi-Layer Feed Forward Neural Network.
6. To perform Load Forecasting using Artificial Neural Network.
7. Write a Matlab program to design Fuzzy Controller for Water Level of Tank.
8. Write a Matlab Program for Neural Controller for CSTR.

Note: Term work shall consist of at least **eight** experiments based on above topics using MATLAB software.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title	Short Title	Course Code
Project-I	**P-I**	

Course Description:
The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**2**

Prerequisite Course(s): .

Course Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.

Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Recognition of the need for, and an ability to engage in life-long learning.
8. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Project-I

(Lab Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination (OR) :25Marks**

- It is expected that the broad area of Project-I shall be finalized by the student in the beginning of the VII semester / extension of Minor project undertaken may be Project-I.
- A group of Minimum 3 and Maximum 5 students shall be allotted for Project-I and same project group for Project-II.
- Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students. The **Synopsis/Abstract** on the selected topic, after detail literature survey should be submitted to the Project coordinator appointed by Head of the department.
- Project-I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data , conduction of experiments and analysis. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.
- Approximately more than 50% work should be completed by the end of VII semester.
- Each student group is required to maintain log book for documenting various activities of Project-I and submit group project report in the form of thermal bound at the end of semester –VII. Submit the progress report in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. *Case study/Analysis/Design Methodology*
    g. *Work to be completed (Progress status)*
    h. *Expected result and conclusion*
    i. *References.*
- Evaluation Committee comprising of the Guide, Project Coordinator and Expert appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Guide lines for ICA : The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Guide lines for ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report**.**

Assessment of Project-I

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Name of Student	Problem Identification and project objectives	Literature Survey	Project Methodology/ Design/PCB/ hardware/ simulation/ programming	Progress Status	Presentation	Total
		5	5	5	5	5	25

Course Title | Short Title | Course Code

Seminar-II

Course Description: The course explores the knowledge of presentation and effective communication. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**2**	**14**	**28**	**2**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

Course Objectives: The objectives of Seminar –II are to develop ability express our view, presentation and effective communication. The scope of seminar-II is study various national and international journal for design , experiments conduct , as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand literature survey for selection of seminar topics.
2. Apply knowledge of mathematics, science, and engineering for effective presentation of selected topic.
3. Communicate effectively and Knowledge of contemporary issues.
4. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
5. Practice the use of various resources to locate and extract information using offline & online tools, journals.
6. Practice the preparation and presentation of scientific papers and seminars in an exhaustive manner.
7. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Seminar-II

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week

1. Each Student shall select a topic for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.
3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-II. Seminar shall be related state of the art topic of his choice approved by the committee.
4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound)in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Literature survey*
    e. *Concept*
    f. *Functional and Technical Details*
    g. *Applications*
    h. Comparison with similar topics / methods
    i. *Future scope*
    j. *References*

ASSESSMENT OF SEMINAR-II

Guide lines for ICA: ICA shall be based on topic selection , presentation and Seminar-II report submitted by the student in the form of thermal bound. Assessment of the Seminar-II for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given in **Table- B**

Name of Guide: _____

Table-B

SN	Name of Student	Seminar Topic	Topic Selection	Literature survey	Report writing	Depth of under-standing	Presentation	Total
			5	5	5	5	5	25

Course Title	Short Title	Course Code
Industrial Visit	**IV**	

Course Description: The course explores the knowledge industry organization, new trends in manufacturing, maintenance and safety. The industrial visit provide the practical visualization of theoretical study of various engineering subject.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**-**	**-**	**-**	**1**

Course Objectives: The main objective behind these visits is to explain the working of industrial equipments in running conditions to the students and tell them about the expectations of the industrialists from the fresh engineers.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand organizational set up of an industry.
2. Develop our self for expectations of the industrialists from the fresh engineers.
3. Understand manufacturing, material handling , maintenance , safety standard and environmental consideration in industry.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Industrial Visit

(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

1. Industry visits for minimum two industries shall be carried out by each student preferably or college shall arrange the industrial visit during the vacation period otherwise during the regular VII semester.
2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of Semester-VII(First Term of Final Year)
4. The report(Thermal Bound) should contain information about the following points:
   a. *The organization - activities of organization and administrative setup technical personnel and their main duties.*
   b. *The project / industry brief description with sketches and salient technical information.*
   c. *The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.*
   d. *Suggestions (if any) for improvement in the working of those organizations.*
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guide lines for ICA : ICA shall be based on knowledge gain by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva -voce as per the guidelines given in **Table- C**

Table-C

SN	Name of Student	Name of Industry	Report writing	Depth of Under-standing	Total
			15	**10**	**25**

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Syllabus for

Final Year Instrumentation Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER –VIII

W.E.F 2015 – 2016

Course Title	Short Title	Course Code
Instrumentation System Design	**ISD**	

Course Description:

Instrumentation play important role in process industry where instrumentation used as controlling and monitoring of various operation. Instrumentation design deals with specification of equipment, layouts, wiring. All activity handled by instrumentation design engineer. The course provide an overview of static and dynamic performance characteristics of instruments. Selection criteria for flow, temperature transducers. Design considerations for transducers such as thermocouple, RTD, orifice plates, Rota meter. Calibration and installation procedure for different transducers

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s) : Sensors and Transducers, Electronic Instrumentation

General Objectives:

The objective of course are as follows:

1. Control Valve Sizing concepts and its usual terms for applications like liquid, gas, vapour and flashing fluids.
2. Control room and Control Panel details
3. The process of Electronic product design

Course Outcomes:

After completion of course the students will be able to:

1. Design and Analyse CV Sizing
2. Identify various Control panels and Control Room details
3. Design of Electronic product.
4. Understand Signal Conditioning for Transducers.

Instrumentation System Design

(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

UNIT-I **09 Hours, 16 Marks**

Basic concepts of transducer design: General transducer design consideration, testing of transducer, and selection criteria of transducer. Design of temperature measurement system based on RTD, Thermocouple and thermisters, Design of Displacement measurement system based using LVDT, Potentiometer, Ultrasonic transducer, Complete signal conditioning circuits for above temperature and Displacement transducers.

UNIT II **09 Hours, 16 Marks**

Design of orifice, rotameter, venture based flow system and signal conditioning circuits for above system. Design of level sensors and its signal conditioning circuits, design of pressure gauge, diaphragm based pressure gauge, Load cell and its signal conditioning, study of P/I and I/P converters, Design of smart transmitters

UNIT III **08 Hours, 16 Marks**

Concept of reliability definition, Distinction between Quality and reliability, failures, Availability, Maintainability, (MTBF, MTTF, MTTR) Life Cycle and Bathtub curve, Reliability Modeling Exponential, Weibull and Gamma Distribution, Hazard rate and Derivation of MTTF Failure Density Function, Cumulative Distribution Function and Reliability, function system Transition Diagrams and Markov Chain modelingcon current and sequential systems. Component and Operational Modes. Reliability Prediction: Life Testing and Accelerated Life testing Burn-in and Initial Failure removal.

UNIT IV **08 Hours, 16 Marks**

Guidelines for enclosure: components and accessories, Grounding and shielding techniques noise in electronic circuits, EMI/ EMC protection against EMI, ESD selection of cables, connectors, types of knobs,; mechanical fixture PCB holders, clamps, control panel layout ergonomics, types of' gear boxes and drives. Ingress protection authorized regulatory bodies for certifying instruments in Hazardous location (BASEEFA, FM, PTB, UL, CESI,LLIE, CSA, DEMKO, IEC&CENELEC).

UNIT V **08 Hours, 16 Marks**

Printed circuit board design guidelines: general components layout scheme, grid system, PCB size mechanical stress, design rules for analog and digital circuit PCB, single, multilayer and SMD boards, Artwork CAD packages, soldering techniques.

Reference Books:

1. Warren Boxleitner, "Electrostatic Discharge and Electronic Equipment, IEEEpresse.
2. Walter C. Bosshart , "Printed Circuit Boards," CEDT series, TMH.
3. Ott, "Noise Reduction Techniques,"
4. E. Balguruswamy, " Reliability Engineering,' PHI.
5. S. Soclof, " Applications of Analog Intergrated Circuit," PHI.
6. B.G.Liptak , "Process Control," Chilton.
7. National Instruments Catalog.
8. E.O.Doebline, "Measurement Systems".
9. C. D, Johnson , "Process control and Instrumentation technology," PHI

Course Title | Short Title | Course Code

Industrial Automation | **IA**

Course Description:

This course describes PLC & SCADA based Industrial Automation system which will improve the knowledge of the students about industrial processes using automation. The course will cover SCADA & PLC systems in terms of their architecture, their interface to the process hardware, the functionality and the application development facilities. Also provide an industrial SCADA & PLC system is used for the development of the controls of machinery.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lectures	**03**	**15**	**42**	**03**

Prerequisite Course(s): Knowledge of c-programming, Industrial organization and management subject of third year, industrial drives and control subject of final year.

Course Objectives:

The objectives of subject are that students will able to understand the role of industrial automation for different processes based on PLC system and its requirement. It also provide basic operation of programmable logic control and its function. Students will learn the input-output devices for the PLC, its operation, its selection according to application and its interfacing. It explores the knowledge of different configuration of PLC, its programming techniques for various application, and it's interfacing with industrial machineries. It also help to understand the application in different industries like power sector, in pharmaceuticals, in automobile industry etc and its installation.

Course Outcomes:

Upon successful completion this course a students will be to

1. Apply the knowledge of automation in machine control.
2. Design and conduct practical in realistic constrain on motors such that it is applicable in manufacturing, testing and maintenance field.
3. Design the automation system for fast and value added quality product for economical growth through technological development.
4. Solve engineering solution for fast growing industrial sector with reliable atomized system using PLC and SCADA system.
5. Discharge professional duty in multidisciplinary teams of installation, maintenance and operation with séance of safety standards.
6. Do higher study in field of automation and able use updated software and tools.

Industrial Automation
(Course Contents)

Semester-VIII **Examination Scheme:**
Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**
Lectures: 3Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**
(ESE) End Semester Exam duration: 03 Hours

Unit I:Introduction to Industrial Automation, basics of PLC and Automation strategy. 09 Hours, 16 Marks

Introduction to Industrial Automation, Role of automation industry, Programmable Logic Controller, Basic operation, PLC architecture and components, Programming language, PLC application and Manufacturers, Introduction to Automation tools like PLC, SCADA, DCS, Hybrid DCS etc.

UnitII Basics PLC Functions and configuration 09 Hours, 16 Marks

PLC registers, PLC modules, Addressing System, Field Input/ Output system, PLC timers functions, PLC counters, Industrial process Timing application, Selection of PLC and I/O modules

Unit III Instructions , Data handling functions 08 Hours, 16 Marks

PLC logical instruction, PLC arithmetic instruction, PLC repetitive clock functions, PLC numbering systems, conversion function, PLC master relay control function, Jump , Data Move instructions and other data handling functions, scaling instructions.

Unit-IV Programming of PLC 08 Hours, 16 Marks

Introduction Ladder/ FBD language, PLC configuration with I/O designations, addressing system in programming, Process to develop ladder language in software, Uploading/ Downloading the program to/ from PLC, To develop ladder for ON/OFF controlling of motor, Traffic signal light, etc.

Unit-V Application of PLC/Industrial application and Introduction to SCADA system. 08 Hours, 16 Marks

Application development and automation for following industries:-

1. Power
2. Pharmaceuticals
3. Automobile
4. Rubber industry etc.

Introduction to SCADA system

Reference Books:

1. John Webb & Ronald, "PLC Principles and Application**",** Prentice Hall India.
2. S.K.Sigh, "Computer Aided Process Control",Prentice Hall India.
3. John Hackworth & Frederick D Hackworth, "PLC: Programming Methods and Applications",Pearson Education.
4. Krushnakant, "Computer Based Process Control" Prentice Hall India.
5. Prof. Rajesh Mehra and Er. VikramVij, "PLC and SCADA", Laxmi Publication, Delhi.
6. http://nptel.iitm.ac.in

Course Title | Short Title | Course Code

Elective-II

Power Plant Instrumentation | **PPI**

Course Description : Instrumentation play important role in power plants where instrumentation used as controlling and monitoring of various operation. The course explores the overview of different power plants and knowledge of different measuring instrument and monitoring instruments are used in power plants. The type and measuring methods changes with respect of type of power plants. The course provide the knowledge of different of instruments use for electrical, thermal and hydraulic system.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lectures	**03**	**15**	**42**	**03**

Course Objectives:

1. To create awareness of energy resources and its scenario in India.
2. To study the concept of power generation using various resources.
3. To study the role of Instrumentation in power plants.
4. To study and compare various power plants for optimal performance

Course Outcomes:

After completion of course students will able to:

1. Understand the over view of different power plants and its operation.
2. Understand the application of instrumentation for measurement, monitoring and safety of human being and assent of power plants.
3. Discharge the technical duties in field of power generation as maintenance and automation engineer.
4. Understand the safety awareness through latest through latest safety equipments.
5. Use latest software and tools of instrumentation for power plant.

Elective-II
Power Plant Instrumentation
(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit - I **09 Hours, 16 Marks**

Fundamentals of generation of Electricity, its transmission and Distribution. Concept of regional and national power grid. Concept of distance protections and is landing types of power plant , introduction and comparison of thermal Power plant, Hydro Electric Power Plant, Nuclear Power Plant, Solar Power Plant.

Unit – II **09 Hours, 16 Marks**

Unit overview, air and fuel path, boiler instrumentation: Combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, oxygen/CO2 in flue gases, furnace draft, boiler interlocks, Start-up and shut-down procedures Boiler load calculation, boiler efficiency calculation.

Unit – III **08 Hours, 16 Marks**

Hydraulically controlled speed governing and turbine steam inlet control valve actuation system. Condenser vacuum control- gland steam exhaust pressure control speed, vibration, shell temperature monitoring-lubricating oil temperature control hydrogen generator. Start-up and shut-down, thermal stress control, condition monitoring and power distribution instrumentation. Synchronous Induction generators cooling system.

Unit – IV **08 Hours, 16 Marks**

Hydro Power Plant: Overview on units, Types of water turbine. Regulation of speed and voltage. Surge tank level control.

Nuclear Power Plant: Overview on units, Concept of energy generated from atomic fission. Block diagram of an Atomic power station. Types of coolants. Control of chain reaction. Radio activity and safety measures. Layout of control rooms. Criterion for selection of Instrumentation system / DCS system for nuclear and hydropower plant.

Unit – V **08 Hours, 16 Marks**

Concept of power generation from non-conventional sources of energy like wind power, Solar Power and Tidal waves. Photovoltaic cells, Hydrogen cells. Power generation using incinerators and bagasse fired boilers. Criterion for selection of Instrumentation system for wind and solar and tidal wave plant.

Reference Books:

1. "Handbook of Instrumentation and Control", H. Kallen, McGraw-Hill Education.
2. "Power plant Engineering", F. Morse, Khanna Publishers.
3. "Modern Power Plant Engineering", J. Balasubramaniam and R. Jain, KhannaPublishers.
4. "Instrument Engineer's Handbook – Process control", B. Liptak, CRC Press.
5. "Distributed Computer Control for Industrial Automation", Bhatkar, DekkarPublication
6. "Power Plant Engineering", Central Electricity Generation Board.
7. "O & M Manuals of Power Plant", Bharat Heavy Electricals Ltd.

Course Title	Short Title	Course Code
Elective-II	**CN**	

Computer Network

Course Description:

This course is aimed at introducing the fundamentals of Computer Networking to undergraduate students. The objective of the course is to understand the basics and knowledge about the Computer Network concepts and different protocols.

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s): Computer Fundamentals

Course Objectives:

Students will learn

1. Data Communications introduction
2. Bandwidth utilization
3. Error Detection and Correction
4. Connecting LANs
5. Network Layer
6. Transport Layer
7. Application Layer
8. WWW and HTTP

Course Outcomes:

Upon the completion of course students will be able to

1. Explain the importance of data communications and the Internet in supporting business communications and daily activities.
2. Explain how communication works in data networks and the Internet.
3. Recognize the different internetworking devices and their functions.
4. Explain the role of protocols in networking.
5. Analyze the services and features of the various layers of data networks.
6. Design, calculate, and apply subnet masks and addresses to fulfill networking requirements.

Elective-II
Computer Network
(Course Contents)

Semester-VIII **Examination Scheme:**
Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**
Lectures: 3Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**
(ESE) End Semester Exam duration: 03 Hours

Unit I **09 Hours, 16 Marks**

Introduction in Computer Networks and Devices, Structure of communication network, Point to point and multi-drop circuits, Network topologies, Hub, switch, router, bridges, additional network components. Network Models. Network software, OSI reference model, TCP/IP reference model, and comparison of OSI and TCP/IP model.

Unit II **09 Hours, 16 Marks**

Physical Layer: Transmission media, wireless transmission, geostationary communication satellite, modems, RS – 232C serial interface, SONET/SDH. Data Link layer: Data Link layer design issues, Error detection and correction, Elementary data link layer protocols, Sliding window protocols, SDLC and HDLC

Unit III **08 Hours, 16 Marks**

Medium Access Sub layers: The Channel allocation problem, multiple access protocols, Ethernet, Bluetooth, Bridges, High speed LAN's.

Network Layer: Need of Network layer, Network layer design issues, routing algorithms, congestion control algorithms.

Unit-IV **08 Hours, 16 Marks**

Internet Working: Concatenated virtual circuits, connectionless internetworking, tunneling, Internet work, routing, fragmentation, and firewalls. Internet and its main applications, Broadband, ISDN and ATM and its reference model.

Internet Protocols: IPv4, IPv6, IP address, Internet control protocols – ICMP, ARP,RARP.

Unit-V **08 Hours, 16 Marks**

Transport Layer: Transport service, Elements of transport protocols, The internet transport protocols – UDP, TCP –Introduction, Services, TCP segment header, connections, Transmission policy and congestion control.

Application Layer: DNS – Domain name system, Electronic mail, World Wide Web, Multimedia.

Reference Books:

1. Andrew S. Tanenbaum, "Computer Networks,"4th edition, Pearson LPE /PHI.
1. BehrouzForouzan , "Data Communications and Networking," TMH, 4thEd.
2. Irvine, "Data Communication and Networks: AnEngg. Approach," Wiley India.
3. S. Keshav , "An Engineering Approach to Computer Networking," PearsonEducation, 5thEd.
2. Irvine Olifer, "Computer Networks:Principles,Technologies and Protocols," Wiley India.

Course Title	Short Title	Course Code
Elective-II **Agricultural Instrumentation**	**AGI**	

Course Description:
This course is aimed at introducing the fundamentals of Instrumentation useful in agriculture field. The objective of the course is to understand the basics and knowledge about the Instrumentation that can be significant in farming and related industries.

Lectures	**Hours/Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	03	**15**	**42**	**03**

Prerequisite Course(s) : Sensors and Transducers

Course Objectives: To acquaint and equip with the concept of instrumentation used in farm power & machinery and measuring devices for force, torque and other parameters.

Course Outcomes:
Upon successful completion of this course the student will be able to:

1. Demonstrate knowledge of digital and analog electronics including dedicated microcomputers in instrumentation and control systems for agricultural
2. Evaluate collected data from an instrumentation system.
3. Identify security risk and determine standard precautionary measures.
4. Apply correct practice to installation, calibration and maintenance of instruments
5. Configure instruments correctly to vendor instruction sheets .
6. Predict and avoid the problems with installing measurement equipment
7. Troubleshoot, isolate and fix electronic instrumentation problems
8. Specify instrument and loop documentation requirements and standards to vendors

Elective-II
Agricultural Instrumentation
(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit -I:- **09 Hours, 16 Marks**

Introduction: necessity of Instrumentation and control for agriculture, food processing and pharmaceutical industries, Sensor requirement remote sensing biosensors in agriculture standards for food quality.

Soil science and sensor: pH conductivity resistively temp. Soil moisture and salinityion concentration measurement, methods of soil analysis.

Instruments for environments conditioning of seed germination and growth.

Unit-II:- **09 Hours, 16 Marks**

Flow Diagram of sugar plant sensors and Instrumentation set up for it. Flow diagramof fermenter and control (batch process), Oil extraction plant and instrumentation setup, Pesticides Manufacturing Process and control, a) Flow diagram of dairy andconfectionery industry and instrumentation set up, Juice Extraction control set up.

Unit-III:- **08 Hours, 16 Marks**

Application of SCADA for dam parameters and control, Water distributions and management control auto drip irrigation systems, Irrigation Canal Management upstream and downstream control systems

Green houses and Instrumentation: Ventilation cooling and heating wind speed temp. and humidity rain gauge carbon dioxide enrichment measurement and control.

Unit -IV:- **08 Hours, 16 Marks**

Automation in earth moving equipment and farm implements pneumatic hydraulic and electronic control circuits in harvesters cotton pickers tractors etc. Application of SCADA and PLC in Packing industry.

Leaf area length evapotr anspiration temp, Wetness and respiration measurement and data logging electromagnetic radiations photosynthesis infrared and UV Bio sensor methods in agriculture, Agrometeorological Instrumentation weather stations.

Unit -V:- **08 Hours, 16 Marks**

Speciality bioproducts for agricultural, food and pharmaceutical industries: Bio-pesticides, bio-fertilizers and plant growth factors. Natural biopreservatives(nisin), biopolymers (xanthan gum pi single cell protein.

Enzymatic bioconversion processes: Production of synthetic penicillins and cephalosra chemically pure drug intermediates. Steroid bio-conversion. High-fructose corn syrp. Bioconversion of vegetable

Biological waste treatment processes: Objectives of biological waste treatment processes. A brief overview of various aerobic and anaerobic processes for removal of organic waste.

References,

1. Patranabis , “Industrial Instrumentation,” ,TMH.
2. B.G.Liptak, “Instrumentation handbook-Process Control” Chilton.
3. C.D.Johnson , “Process Control and Instrumentation technology,”,PHI.
4. Wills B.A., "Mineral Processing Technology", 4th Ed.,Pergamon Press.

Course Title	Short Title	Course Code
Elective-II		
Soft Computing	**SC**	

Course Description:

This course is designed to introduce students with the fundamentals of soft computing methods such as fuzzy logic, neural network and genetic algorithms. The course covers the area of the soft computing applied in the field of instrumentation engineering.

Lectures	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	03	15	42	03

Prerequisite Course(s) : Fuzzy Logic, Set Theory

Course Objectives: The objective of this course is to teach basic neural networks, fuzzy systems, and optimization algorithms concepts and their relations.

Course Outcomes:

Upon successful completion of this course the student will be able to:

1. Implement numerical methods in soft computing
2. Explain the fuzzy set theory
3. Apply derivative based and derivative free optimization
4. Discuss the neural networks and supervised and unsupervised learning networks.
5. Comprehend neuro fuzzy modeling
6. Demonstrate some applications of computational intelligence

Elective-II
Soft Computing
(Course Contents)

Semester-VII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit-I **09 Hours, 16 Marks**

Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement. Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning. Fuzzy inference systems: Mamdani model- Sugeno model. Tsukamoto model

Unit-II **09 Hours, 16 Marks**

Fuzzy decision making, Multiobjective Decision Making--Fuzzy classification-Fuzzy control methods – Application Neuro-Fuzzy Modeling: Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress- CART algorithm

Unit-III **08 Hours, 16 Marks**

Data clustering algorithms: K means clustering- Fuzzy C means clusteringMountain clustering- Subtractive clustering – rule base structure identification

Neuro fuzzy control: Feedback Control Systems- Expert Control- Inverse Learning- Specialized Learning- Back propagation through Real Time Recurrent Learning.

Unit-IV **08 Hours, 16 Marks**

Genetic Algorithms: Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction, Genetic Modeling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest - crossover- Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization simulated annealing- Random search- Downhill simplex search

Unit-V **08 Hours, 16 Marks**

Application Applications of Computational Intelligence: Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Reference Books

1. J.S.R. Jang, C.T. Sun and E. Mizutani, “Neuro-Fuzzy and Soft Computing” PHI/Pearson Education
2. S. Rajasekaran&G.A. VijayalakshmiPai, PHI
3. T. J. Ross, “Fuzzy Logic with Engineering Applications.” TMH
4. LaureneFausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications ”, Pearson Education India, 2006
5. S.N. Sivanandam, S.N. Deepa, “Introduction to Genetic Algorithm”, Springer 2008

Course Title	Short Title	Course Code
Elective-III		
Optimal & Adaptive Control	**OAC**	

Course Description:

This course is designed to introduce students with the fundamentals of optimal and adaptive control. The course covers the area of the controller design for variations in process parameters. This subject gives undergraduate students the basic knowledge of the controller design for linear, nonlinear process, non-stationary processes.

Lectures	Hours/Week	No. of Weeks	Total Hours	Credits
	03	15	42	03

Course Objectives:

Applications of Optimal and Adaptive controls are growing in practical and industrial control systems. The objective of this course is to present an overview of theoretical and practical aspects of optimal and adaptive control. The theory of adaptive control techniques and related issues are covered in detail.

Course Out comes:

After completion of subject students will be able to:

1. Design and implement system identification experiments.
2. Use input-output experimental data for identification of mathematical dynamical models.
3. Use system identification methods to design adaptive controllers.
4. Explain the advantages and disadvantages of adaptive control relative to other control approaches.

Elective -III
Optimal & Adaptive Control
(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit –I **09 Hours, 16 Marks**

Introduction to adaptive control, Effects of process variations, Adaptive controls schemes, Adaptive control problem, Non-parametric identification, Step response method, Impulse response method, and Frequency response method.

Unit –II **09 Hours, 16 Marks**

Linear in parameter models, ARX, ARMAX, ARIMAX, Least square estimation, Recursive least square estimation, Extended least square estimation, Maximum like estimation, Introduction to non-linear systems identification, Pseudorandom binary sequence.

Self-tuning regulator: Deterministic in-direct self-tuning regulators, Deterministic direct self-tuning regulators, Introduction to stochastic self-tuning regulators, Stochastic indirect self-tuning regulator.

Unit –III **08 Hours, 16 Marks**

Model reference adaptive controller: The MIT rule, Lyapunov theory, Design of model reference adaptive controller using MIT rule and Lyapunov theory, Relation between model reference adaptive controller and self-tuning regulator.

Tuning of controllers and case studies: Design of gain scheduling controller –Auto-tuning of PID regulator, Stability analysis of adaptive controllers – Application of adaptive control in chemical reactor, distillation column and variable area tank system.

Unit –IV **08 Hours, 16 Marks**

Statement of optimal control problem, Problem formulation and forms of optimal control, Performance measures for optimal control, Selection of performance measure, Various methods of optimization, Linear programming, Non-linear programming, Dynamic programming

Unit –V **08 Hours, 16 Marks**

Principle of optimality, recurrent relation of dynamic programming for optimal control problem, Computational procedures for solving optimal control problems,

Characteristics of dynamic programming solution, Hamilton Jacobi Bellman equation, Application to a continuous linear regulator problem.

References Book:

1. "Adaptive Control",Karl J. Astrom& Bjorn Wittenmark, Pearson Education(Singapore), Second Edition, 2003.
2. "System Identification," C.H.A. Hsia, Lexington books, 1974.
3. "Chemical Process Control", Stephanopoulis G, Prentice Hall of India, NewDelhi, 1990.
4. "Optimal Control Theory – An Introduction" Donald E. Kirk, PearsonEducation, 1970.
5. "Robust & Optimal Control", KeminZbou, J.C. Doyle, Pearson Education,1996.
6. "Modern Control System Theory" M. Gopal New Age International Ltd.
7. "Control System Design – The Optimal Approach"',B. Sarkar", WheelerPublishing, New Delhi, 1997.

Course Title | Short Title | Course Code

Elective-III

Nano Instrumentation | **NI**

Course Description: The course explores basic concepts of nano-devices and various sensors. It also provides knowledge about the applications of nanotechnology

Lectures	Hours/Week	No. of Weeks	Total Hours	Credits
	03	15	42	03

Course Objectives:

1. To explain students to basic concepts of nano-devices and various sensors.
2. To provide knowledge about the applications of nanotechnology

Course Outcomes:

After completion of course students will be able to

1. Understand the working of MEMS and NEMS
2. Understand the applications of nano-sensors and detectors

Elective-III
Nano Instrumentation.
(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit –I **09 Hours, 16 Marks**

Physical Properties of Nanoscale Structures: Energy subbands and Density of states in nanoscale structure, electron transport in a two dimensional electron gas, resistance of ballistic conductor,landauer formula, transmission probability calculation, electron tunneling ,resonant tunneling devices, coupled nanoscale structures and super lattices ,Columb blockade, Quantization of thermal conductance in ballistic nanostructures, non ballistic electron propagation. Nanotechnology: Deposition technique for nanoscale devices, nanolithography, self assembly technique Nanomaterials: nanoparticales, nanowires, nanomagnetic materials, nanostructered Surfaces

Unit -II **09 Hours, 16 Marks**

MEMS and NEMS: Micro and nanocantilevers, frequency analysis Micro and nanocantilevers, Quality factor and noise of cantilevers, magnetic and optical actuation of cantilevers Scaning probe Instrumentation for nanoelectronics: The Atomic force Microscope (AFM), scanning tunneling Microscopy, scanning near field optical Microscopy

Unit_III **08 Hours, 16 Marks**

Physical properties: band structure and band modulation, electrical properties of CNT's

CNT based electronic Devices: The CNT Transistor, CNT based field emission Devices junction, hetrojunction and quantum confined structure based on carbon nanotube, microwave devices based on carbon nano tube, CNT based NEMS

Unit IV **08 Hours, 16 Marks**

Physical Principle of Spintronic Devices: Spin relaxation mechanism, spin injection, and spin detection,

Spontaneous Devices: spin filter, spin valve, spin pump, spin diode, spin transistor, Spin based optoelectronic devices, spintronic computation

Unit _V **08 Hours, 16 Marks**

Design of nano-transducers, nano-mechanical elements, nano-mechanical sensors,nano-meter precision position measurement, electrically controlled nano-actuators, chemically driven nano-actuators, quantum dots and localization of elementary Particles, nano switches ,molecular switches, and logic element, particle Emitting nano transducers, magnetic nano-transducers, chemical nano-scale sensors and actuators, Optics-optoelectronic devices based on nano-wires, optoelectronic devices based on Nano-particles

Reference Books:

1. Nanoelectronics: Principles and Devices Mircea Dragoman, Diniela Dragoman, Artech House, Boston (2006)
2. Nanotechnology:An introduction to nanostructuring technique Michael Kohler, Wolfgang fritzsche, Wiley –VCH (2007)
3. Handbook of Nanotechnology, Bhusan (Editor) Springer, Berlin Heidelberg New York (2010)

Course Title Short Title Course Code

Elective-III
Automotive Instrumentation AI

Course Description: The course provide the fundamental knowledge of principles of electronics and to introduce the application of electronics in the modern automobile. It also deals in understanding of automotive systems and various electronic accessories used in automobile.

Lectures	Hours/Week	No. of Weeks	Total Hours	Credits
	03	15	42	03

Course Objectives:

- To learn the fundamental principles of electronics and to introduce the application of electronics in the modern automobile.
- To develop ability to understand various latest Communication protocols used in automobile industries.
- To provide a thorough understanding of automotive systems and various electronic accessories used in automobile.

Course Outcomes:

After completion of course students will be able to

- Analyze the use of instruments in automotive industry
- Design instruments for automotive applications.
- Use Communication protocols to perform advanced monitoring and control.

Elective-III
Automotive Instrumentation
(Course Contents)

Semester-VIII **Examination Scheme:**
Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**
Lectures : 3 Hrs/Week **(ISE)Internal Sessional Examination: 20 Marks**
(ESE) End Semester Exam duration: 03 Hours

Unit –I **09 Hours, 16 Marks**

Fundamentals of Automotive Electronics: Open loop and closed loop systems components for electronic engine management, vehicle motion control, Current trends in modern Automobiles

Unit –II **09 Hours, 16 Marks**

Electronic Fuel Injection and ignition systems: Introduction, Carburettor control system, throttle body ignition and multi port or point fuel injection, Advantages of electronic ignition system, Types of solid state ignition systems and their principle of operation, electronic spark timing control system,

Unit- III **08 Hours, 16 Marks**

Engine control system: Engine cranking and warm up control, Acceleration enrichment De-acceleration leaning and idle speed control, integrated engine control system, exhaust emission control system, Engine performance testing Automobile chassis electronic control system: Principle of electronic braking, automatic transmission electronic control circuit, cruise control circuit, the electronic steering control theory, ABS, ASR, ESP, and other electronic control method

Unit -IV **08 Hours, 16 Marks**

Auto Body Electronic Control Technology: Automotive central locking and anti-theft system control technology, electronically controlled windows and doors and airbag technology, principle of control circuit components and characteristics.

Unit -V **08 Hours, 16 Marks**

Ergonomics and safety: Driver information system, lighting system components, battery monitoring and control, Air conditioning, steering control techniques, Automatic gear control systems, Emission standards.

Reference Books:

1. William B. Riddens, “Understanding Automotive Electronics”, 5th Edition, (Butterworth Heinemann Woburn), (1998).
2. Tom Weather Jr and Cland C. Hunter, “Automotive Computers and Control System”,Prentice Hall Inc. ,New Jeresy.
3. Jiri Marek, Hans Peter trah, “Sensers Applications, Sensers for Automotive Technology” 1st Edition , Wiley
4. T. Mellard, Automotive Electronic Systems” 1987 by Heinenmann Professional

Course Title Short Title Course Code

Elective-III

Embedded Systems ES

Course Description: An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular kind of application device. The course makes students understand the 32bit processors and higher architectures and configuration**.** Use of Real Time systems and there design in Instrumentation systems.

Lectures	Hours/Week	No. of Weeks	Total Hours	Credits
	03	15	42	03

Course Objectives:

1. To learn about the Embedded Processors with Real World applications.
2. To introduce the concept of control applications in embedded systems.
3. To enhance the knowledge in interfacing processes with embedded controllers.

Course Outcomes:

1. Write programs in an IDE and download it to the Processor.
2. Design and program Embedded circuits.
3. Design control algorithms in an embedded processor.

Elective-III
Embedded Systems
(Course Contents)

Semester-VIII **Examination Scheme:**
Teaching Scheme **(ESE) End Semester Examination: 80 Marks**
Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**
(ESE) End Semester Exam duration: 03 Hours

Unit -I: - **09 Hours, 16 Marks**

Introduction to functional building blocks of embedded systems: Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories.

Unit -II: - **09 Hours, 16 Marks**

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

Unit_III: - **08 Hours, 16 Marks**

I/O devices; timer & counting devices; serial communication using I2C, CAN, USBbuses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Serial port & parallel port.

Unit IV: **08 Hours, 16 Marks**

Intel I/O instruction: Transfer rate, latency; interrupt driven I/O, Non maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts.

Multi threaded programming: Context switching, premature & non-premature multitasking, semaphores.

Scheduling: Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

Unit _V: - **08 Hours, 16 Marks**

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process, Action plan, use of target system, emulator, use of software tools.

Reference Books:

1. Embedded System – Architecture, Programming, Design, “Rajkamal”, TataMcGraw Hill, 2003.
2. Fundamentals of Embedded Software, “Daniel W. Lewis”, Prentice Hall ofIndia, 2004.
3. An Embedded Software Primer, “David E. Simon”, Pearson Education, 2004.
4. Embedded System Design – A Unified hardware & Software Introduction,“Frank Vahid”, John Wiley, 2002.
5. Embedded Real Time Systems Programming, “Sriram V. Iyer, PankajGupte”,Tata McGraw Hill, 2004.
6. Embedded System Design, “Steve Heath”, II edition, Elsevier, 2003.

Course Title	Short Title	Course Code
Instrumentation System Design Lab	**ISD Lab**	

Lab course Description: Instrumentation play important role in process industry where instrumentation used as controlling and monitoring of various operation. Instrumentation design deals with specification of equipment, layouts, wiring. All activity handled by instrumentation design engineer. The course provide an overview of static and dynamic performance characteristics of instruments. Selection criteria for flow, temperature transducers. Design considerations for transducers such as thermocouple, RTD, orifice plates, Rota meter. Calibration and installation procedure for different transducers

Practical	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**15**	**28**	**1**

Lab Course Objectives:

To make students to understand

1. Control Valve Sizing concepts and its usual terms for applications like liquid, gas, vapour and flashing fluids.
2. Control room and Control Panel details
3. The process of Electronic product design

Lab Course Outcomes:

Upon successful completion of this course the student will be able to:

1. Design and Analyse CV Sizing
2. Identify various Control panels and Control Room details
3. Design of Electronic product.
4. Signal Conditioning for Transducers.

Instrumentation System Design Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Design of signal conditioning for displacement measurement transducer..
2. Design of signal conditioning RTD (Pt-100)
3. Design of signal conditioning for thermocouple
4. Study and Calibration of I/P & P/I converter
5. Study of D.P. Transmitter and its application for flow
6. Study of D.P. Transmitter and its application for level
7. Study of smart transmitter
8. Design of signal conditioning for load cell.
9. Study of Enclosure design for circuit and instrument.
10. Design of PCB on above any one signal conditioning application

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student should be asked to perform any one practical. Evaluation will be based on practical, paper work , performance and oral in the practical examination.

Course Title	Short Title	Course Code
Industrial Automation Lab	**IA Lab**	

Lab Course Description:

This lab course describes PLC & SCADA based Industrial Automation system which will improve the knowledge of the students about industrial processes using automation. The course will cover SCADA & PLC systems in terms of their architecture, their interface to the process hardware, the functionality and the application development facilities. Also provide an industrial SCADA & PLC system is used for the development of the controls of machinery.

Practical	**Hours/Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	02	**15**	**28**	**01**

Prerequisite Course(s): Knowledge of c-programming, Industrial organization and management subject of third year, industrial drives and control subject of final year.

Lab Course Objectives:

The objectives of lab course are that students will able to understand the role of industrial automation for different processes based on PLC system and its requirement. It also provide basic operation of programmable logic control and its function. Students will learn the input-output devices for the PLC, its operation, its selection according to application and its interfacing. It explores the knowledge of different configuration of PLC, its programming techniques for various application, and it's interfacing with industrial machineries. It also help to understand the application in different industries like power sector, in pharmaceuticals, in automobile industry etc and its installation.

Course Outcomes:

Upon successful completion this course a students will be to

1. Apply the knowledge of automation in machine control.
2. Design and conduct practical in realistic constrain on motors such that it is applicable in manufacturing, testing and maintenance field.
3. Design the automation system for fast and value added quality product for economical growth through technological development.
4. Solve engineering solution for fast growing industrial sector with reliable atomized system using PLC and SCADA system.
5. Discharge professional duty in multidisciplinary teams of installation ,maintenance and operation with séance of safety standards.
6. Do higher study in field of automation and able use updated software and tools.

Industrial Automation Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Study of different PLC and their specification.
2. Study of installations and troubleshooting of PLC.
3. Solving example by LD and ST programming in PLC.
4. Solving example by timer and counter in PLC.
5. Solving example using SFC programming in PLC.
6. Study of Interfacing between PLC and Process loop.
7. Develop a one application on SCADA system.
8. Study different type of DCS and their latest trends.
9. Selection steps of DCS for industrial automation.
10. Study of specification list for DCS.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student should be asked to perform any one practical. Evaluation will be based on practical, paper work , performance and oral in the practical examination.

Course Title Short Title Course Code

Elective-II

Power Plant Instrumentation Lab

Lab Course Description : Instrumentation play important role in power plants where instrumentation used as controlling and monitoring of various operation. The course explores the overview of different power plants and knowledge of different measuring instrument and monitoring instruments are used in power plants. The type and measuring methods changes with respect of type of power plants. The course provide the knowledge of different of instruments use for electrical, thermal and hydraulic system.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Practical	**02**	**15**	**28**	**01**

Lab Course Objectives:

1. To create awareness of energy resources and its scenario in India.
2. To study the concept of power generation using various resources.
3. To study the role of Instrumentation in power plants.
4. To study and compare various power plants for optimal performance

Course Outcomes:

After completion of course students will able to:

1. Understand the over view of different power plants and its operation.
2. Understand the application of instrumentation for measurement, monitoring and safety of human being and assent of power plants.
3. Discharge the technical duties in field of power generation as maintenance and automation engineer.
4. Understand the safety awareness through latest through latest safety equipments.
5. Use latest software and tools of instrumentation for power plant.

Elective-II

Power Plant Instrumentation Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

1. Study of instrumentations for Hydro-electric and thermal power plant.
2. Study of instrumentations for safety in Nuclear power plants.
3. Study of solar power analyzer and wind flow meter for solar and wind power plants.
4. Design and development of interlocks and safety system for thermal power plants.
5. Selection of instrumentation system for thermal power plant.
6. Design of boiler automation using DCS and PLC.
7. Study on boiler safety instrumentation.
8. Study on turbine control system.
9. Study on regional and national power grid.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title Short Title Course Code

Elective-II

Computer Network Lab **CN Lab**

Lab Course Description: This course is aimed at introducing the fundamentals of Computer Networking to undergraduate students. The objective of the course is to understand the basics and knowledge about the Computer Network concepts and different protocols.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Practical	**02**	**15**	**28**	**01**

Prerequisite Course(s):

Computer Fundamentals

Lab Course Objectives:

- Data Communications introduction
- Bandwidth utilization
- Error Detection and Correction
- Connecting LANs
- Network Layer
- Transport Layer
- Application Layer
- WWW and HTTP
- Aiming at Conducting seminars, tutorials and remedial classes

Course Outcomes:

- Explain the importance of data communications and the Internet in supporting business communications and daily activities.
- Explain how communication works in data networks and the Internet.
- Recognize the different internetworking devices and their functions.
- Explain the role of protocols in networking.
- Analyze the services and features of the various layers of data networks.
- Design, calculate, and apply subnet masks and addresses to fulfill networking requirements.
- Analyze the features and operations of various application layer protocols such as Http, DNS, and SMTP.

Elective -II

Computer Network Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments.

1. Study of network resources and various components.
2. Use of RS – 232C for character transfer (Half duplex, Full duplex)
3. Use of RS – 232C for file transfer between two personal computers (Half duplex,Full duplex)
4. Sliding window protocols using RS 232c.
5. Interconnection of personal computers and PSTN (Public switching TelephoneNetworks) using MODEMS.
6. Data transfer and sharing resources in LAN.
7. Study of WAN.
8. Study of variousapplication like Electronic mail, E- commerce, WWW.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by students in oral examination.

Course Title | Short Title | Course Code

Elective-II

Agricultural Instrumentation

Practical	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	02	15	28	01

Prerequisite Course(s) : Sensors and Transducers

Course Objectives: To acquaint and equip with the concept of instrumentation used in farm power & machinery and measuring devices for force, torque and other parameters.

Course Outcomes:

Upon successful completion of this course the student will be able to:

1. Demonstrate knowledge of digital and analog electronics including dedicated microcomputers in instrumentation and control systems for agricultural
2. Evaluate collected data from an instrumentation system.
3. Identify security risk and determine standard precautionary measures.
4. Apply correct practice to installation, calibration and maintenance of instruments
5. Configure instruments correctly to vendor instruction sheets .
6. Predict and avoid the problems with installing measurement equipment
7. Troubleshoot, isolate and fix electronic instrumentation problems
8. Specify instrument and loop documentation requirements and standards to vendors

Agricultural Instrumentation Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

1. To test soil PH, conductivity, resistivity, temperature, moisture and salinity.
2. To study instrumentation set-up for Sugar plant.
3. To study flow diagram of fermenter and control (Batch process).
4. To study pesticides manufacturing process and control.
5. To study flow diagram of Diary and confectionary industry and instrumentation set-up.
6. To study juice extraction control set-up.
7. To study application of SCADA for DAM and irrigation systems.
8. To study automation in farm equipments.
9. To study Instrumentation and Control in Green house.
10. To study different bio-sensors methods in agriculture

Note: Term work shall consist of at least **eight** experiments based on above topics

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal and drawing sheet.

Guide lines for ESE:-

In ESE the student may be asked questions on drawing sheet. Evaluation will be based on answers given by students in oral examination.

Course Title | Short Title | Course Code

Elective-II

Soft Computing

Practical	Hours/Week	No. of Weeks	Total Hours	Semester Credits
	02	15	28	01

Prerequisite Course(s):

Lab Course Objectives:

- To introduce the basic concepts of neural networks and its applications in Control.
- To introduce fuzzy logic concept and its applications in Control.
- To introduce genetic algorithm

Lab Course Outcomes:

- Design Fuzzy Logic and Neural Network based application
- Use Soft Computing to solve real world problems mainly pertaining to Control system applications.
- Suggest an appropriate control approach for different applications.

Soft Computing Lab

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

1. Write a MATLAB program to implement discrete hopefield network and test for input pattern.
2. Write a MATLAB program to implement full counter propagation network for a given input pattern.
3. Write a MATLAB program to implement back propagation network for a given input pattern.
4. Write a MATLAB program to implement fuzzy set operation and properties.
5. Write a program to implement composition of fuzzy and crisp relations.
6. Write a MATLAB program for maximizing f(x) = x2 using genetic algorithm, where x is rangesfrom0 to 31. Perform only 5 iteration.
7. Design Fuzzy Controller for level control of Process Tank.
8. Design Neural Controller for level control of Process Tank.
9. Design Fuzzy Controller for CSTR.
10. Design Neural Controller for CSTR.

Note: Term work shall consist of at least **eight** experiments based on above topics

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal and drawing sheet.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by students in oral examination.

Course Title	Short Title	Course Code
Industrial Lecture	**I.L.**	

Course Description:

The gap between industry's needs and the academic community's aspirations appears to be considerably large. There exists a strong feeling, at least in the academic circles, that unless technology driven initiatives find a surer place in the industrial sector in this country, the academia-industry interaction is likely to remain confined to developmental activities with limited exploratory or research-based content As institutes committed primarily to creation and growth of technological knowledge, technical institutes have an important role to play in the industrial sector of the country's economy. This fact by way of encouraging mechanisms to foster interaction between the academia and industry. Typically, academic interest in the multidimensionality of a problem leads to a tendency to explore a variety of options to arrive at a solution. This industrial lecture develops ability of student for expectations of the industrialists from the fresh engineers.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**1**	**15**	**14**	**2**

Course Objectives: The domains in which interaction is possible are:

a. Placement and entrepreneurship development.
b. Industry participation in technology development involving some exploratory work.
c. Academic intervention in solving specific industry problems.
d. Laboratory utilization by industry.
e. Continuing education program.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand need ,requirement and expectation of industry from fresh engineers.
2. Understand importance of laboratory practices throughout carrier of engineer. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Recognition of the need for, and an ability to engage in life-long learning use of modern engineering tools.

Industrial Lecture

(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 50Marks**

Lecture : 1 Hrs/Week

1. There is a need to create avenues for a close academia and industry interaction through all the phases of technology development, starting from conceptualization down to commercialization.
2. List of renowned persons from industry shall be prepared by the committee appointed by Head of the department. After approval from the Principal, Minimum five Industrial lectures in alternate week shall be arranged, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors / R&D Labs covering the various aspects.
3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
4. Minimum **five** Lectures to be delivered by experts from the industry in alternate weeks.
5. Students shall submit the report based on minimum five lectures giving summary of the lecture delivered.
6. The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in bullet point form.

Guide lines for ICA : Assessment of the Industrial Lecture for award of ICA marks shall be done jointly by departmental committee as per attendance in industrial lecture, report submitted by student and overall performance in semester as per the guidelines given in **Table- D**

Table-D

SN	Name of Student	Attendance (05 Marks per Lecture)	Dept of Understanding (03 Marks per Lecture)	Report Writing	Total
		25	15	10	50

Course Title	Short Title	Course Code
Project-II	**P-II**	

Course Description:

The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Laboratory	**4**	**15**	**48**	**6**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

Course Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Recognition of the need for, and an ability to engage in life-long and self learning.
8. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Project-II

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 75Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination (OR) :75Marks**

1. Project-I work decided in VII semester shall be continued as Project-II
2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before end of semester.
3. Project-II may involve fabrication, design , experimentation , data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing , possible results and report writing
4. Each students project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VIII in the form of Hard bound.
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. *Case study/Analysis/Design Methodology*
    g. *Project design and implementation details*
    h. *Result and conclusion*
    i. *Future scope*
    j. *references.*

Guide lines for ICA : ICA shall be based on continuous evaluation of students performance throughout semester in project-II and report submitted by the students project group in the form Hard bound. Assessment of the project-II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-D.**

Guide lines for ESE:-

In ESE the student may be asked for demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.

Assessment of Project-II

Name of the Project: _____

Name of the Guide: _____

Table-D

		Assessment by Guide (50 Marks)				Assessment by Committee (25 Marks)		
SN	**Name of Student**	**Attendance , Participation and team work**	**Material procurement/ assembling/Designing/Programming**	**Case study/ Execution**	**Project Report**	**Dept of Understan-ding**	**Presentation**	**Total**
Marks		**10**	**15**	**15**	**10**	**10**	**15**	**75**