R22

M.Tech. (ELECTRONICS & INSTRUMENTATION)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION OF THE DEPARTMENT

A resource center of academic excellence for imparting quality technical education, meeting the need of students at National and International levels and imbibing strong ethical values, to improve the standards of the society.

MISSION OF THE DEPARTMENT

- To impart quality education in the domain of Electronics and Instrumentation Engineering by Implementing learning centric processes.
- To provide specific best of breed laboratory practices to promote diverse collaborative research for meeting the changing societal needs.

M.TECH.
(ELECTRONICS AND INSTRUMENTATION)

M.TECH. (E&I)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To Excel in professional career and/or higher education by acquiring knowledge in measurements, transduction, and instrumentation engineering principles

PEO-II: To enhance knowledge to design & develop advanced instrumentation and automation systems for remote monitoring and control applications.

PEO-III: To analyze real life problems, design data acquisition systems with computing platforms appropriate to Electronics and Instrumentation that are economically feasible and acceptable.

PEO-IV: To acquire soft skills through teamwork, presentations, seminar, and dissertation.

PEO-V: To serve research and development organizations to solve the problems raised in the industries and society and involve in lifelong learning.

M.TECH. (E&I)

PROGRAM OUTCOMES

PO-1: To independently carry out research /investigation and development work to solve practical problems.

PO-2: To write and present a substantial technical report/document.

PO-3: To demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO-4: To identify suitable sensors and transducers for real time applications.

PO-5: To Acquire knowledge of Instrumentation Engineering with ability to evaluate, analyze and synthesize problems related to process oriented industries.

PO-6: To use innovative technologies, skills and modern engineering tools to carry out projects related to real-life applications like Robotics, Analytical and Biomedical instruments

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(ELECTRONICS & INSTRUMENTATION)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1LI01	Transducers and Smart Instruments	3	0	0	3
Professional Core-II	22PC1LI02	Signal Conditioning Circuits	3	0	0	3
Professional Core-III	22PC1LI03	Process Control Instrumentation	3	0	0	3
Professional Elective-I	22PE1LI01	Data Acquisition Systems	3	0	0	3
	22PE1ES18	Embedded Systems				
	22PE1LI02	Robotics and Control Instrumentation				
	22PE1LI03	Digital Image Processing				
	22PE1LI04	Power Plant Instrumentation				
Professional Elective-II	22PE1LI05	Fiber Optics and Laser Instrumentation	3	0	0	3
	22PC1CP05	Internet of Things				
	22PE1LI06	VLSI Technology and Design				
	22PE1LI07	Analytical instrumentation				
	22PE1LI08	Instrumentation for Agricultural and Food Processing Industries				
Professional Core Lab-I	22PC2LI01	Instrumentation Laboratory	0	0	3	1
Professional Core Lab-II	22PC2LI02	Process Control with Python - Laboratory	0	0	3	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing				1
Project	22PW4LI01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(ELECTRONICS & INSTRUMENTATION)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1LI04	PLC, SCADA Programming and their Applications	3	0	0	3
Professional Core-V	22PC1LI05	Virtual Instrumentation	3	0	0	3
Professional Core-VI	22PC1LI06	Medical Electronics	3	0	0	3
Professional Elective-III	22PE1LI09	Industrial and Power Electronics	3	0	0	3
	22PE1LI10	Industrial Internet of Things				
	22PE1LI11	Nano Technology				
	22PE1LI12	Neural Networks and Fuzzy Systems				
	22PE1LI13	Pollution Control in Process Industries				
Professional Elective-IV	22PE1LI14	Process Data Analytics	3	0	0	3
	22PE1LI15	Industrial Data Communication				
	22PE1LI16	Micro Electro-Mechanical Systems				
	22PE1LI17	Instrumentation In Paper and Pulp Industries				
	22PE1LI18	Instrumentation For Pharmaceutical Industry				
Professional Core Lab-III	22PC2LI03	Industrial Process Control and Automation Laboratory	0	0	3	1
Professional Core Lab-IV	22PC2LI04	Virtual Instrumentation Laboratory	0	0	3	1
Industry Engagement	22SD5LI01	Industry Engagement	0	0	2	1
Project	22PW4LI02	Mini-Project	0	0	4	2
Mandatory	22MN6HS01	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(ELECTRONICS & INSTRUMENTATION)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1LI19	Instrumentation System Design	3	0	0	3
	22PE1LI20	Cyber Security for Industrial Automation				
	22PE1LI21	Bio-Medical Signal Processing				
	22PE1LI22	Nonlinear Adaptive Control				
	22PE1LI23	Instrumentation and Control for Petrochemical Industries				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4LI03	Project Part - I	0	0	16	8
Total			**8**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4LI04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1LI01) TRANSDUCERS AND SMART INSTRUMENTS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To impart knowledge on transducer characteristics
- To make the students understand the importance of error analysis and to determine the uncertainties associated with measuring instruments
- To make the students understand the importance of smart sensor technologies and familiarization of standards for smart sensor interface
- To provide exposure to manufacturing techniques and different Micro sensors and actuators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize and characterize a conventional transducer
CO-2: Analyze and quantify the uncertainties in measurement data
CO-3: Design smart sensors with special features
CO-4: Comprehensive knowledge of manufacturing techniques and design aspects of micro sensors and actuators
CO-5: Keep abreast of the latest sensor technology and advanced measurement methodologies

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	-	3	3	2
CO-2	2	1	-	3	2	2
CO-3	2	3	-	3	3	2
CO-4	2	1	-	3	2	3
CO-5	3	2	-	3	3	2

UNIT-I:

Overview of Conventional Transducers and their Characteristics: Overview of conventional sensors - Resistive, Capacitive, Inductive, Piezoelectric, Magnetostrictive and Hall Effect sensors - Static and Dynamic Characteristics of Transducers and specifications.

UNIT-II:

Measurement Error and Uncertainty Analysis: Importance of error analysis - precision and accuracy -Random errors - Distributions, mean, width of the distribution and standard error - Uncertainty as probability - Gaussian and Poisson probability distribution functions, confidence limits, error bars, and central limit theorem - Error

propagation - single and multivariable functions, propagating error in functions - Data visualization and reduction- Least square fitting of complex functions.

UNIT-III:

Smart Sensors: Definition – Integrated smart sensors - Interface electronics - Design, sensing elements and parasitic effects, ADC, Accuracy and Dynamic range - Universal Sensor Interface–converters - front end circuits. DAQ – Design - Digital conversion techniques.

UNIT-IV:

Signal Processing for Smart Sensors: Microcontrollers and digital signal processors for smart sensors–selection - Timer, Analog comparator, ADC and DAC modules– Remote calibration– Smart Transducer Interface standard (IEEE 1451)- Interfacing Resistive and Inductive sensors to microcontrollers without ADC– Smart transmitters: - HART, FF and Profibus.

UNIT-V:

Micro Sensors and Actuators: Micro system design and fabrication–Micro pressure sensors (Piezo resistive and Capacitive)–Resonant sensors– Acoustic wave sensors–Bio micro sensors–Microactuators – Micromechanical motors and pumps- Introduction to Nano sensors.

TEXT BOOKS:

1. Measurement Systems Application and Design, Ernest O. Doebelin and Dhanesh N. Manik, 6th Edition, Tata Mc-Graw Hill, 2011
2. Measurements and their Uncertainties: A Practical Guide to Modern Error Analysis, Ifan G. Hughes and Thomas P. A. Hase, Oxford University Press, 2010
3. Smart Sensor Systems, Gerord C. M. Meijer, John Wiley and Sons, 2008

REFERENCES:

1. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, Tata McGraw Hill, 2002
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1LI02) SIGNAL CONDITIONING CIRCUITS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the working principle and design of various analog signal conditioning circuits used in industrial applications
- To impart knowledge on the design of signal conditioning circuits
- To impart the knowledge of various measurement methods of physical parameters like velocity, acceleration, torque, pressure, flow, temperature etc. and their relevance to Industry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand principle of working of various signal conditioners used with Temperature, Displacement, optical and various miscellaneous other sensors
CO-2: Design signal conditioning circuits for various transducers
CO-3: Understand applications of various signal conditioners used in industry
CO-4: Capable of selecting best suited signal conditioners for any given application

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	-	3	3	2
CO-2	2	-	-	2	3	2
CO-3	2	-	-	2	3	2
CO-4	3	-	-	3	3	2

UNIT-I:
Signal Conditioning for Resistive Sensors: Measurement of Resistance, Voltage Dividers Wheatstone Bridge: Balance Measurements, Detection Measurements, Differential and Instrumentation Amplifiers, Interference.
Signal Conditioning for Self-Generating Sensors: Chopper and Low-Drift Amplifiers, Electrometer and Trans impedance Amplifiers, Charge Amplifiers, Noise in Amplifiers, Noise and Drift in Resistors.

UNIT-II:
Temperature Sensors Interfacing: Thermo Switches, Thermocouples Interfacing – Thermo switches, Ambient Referenced Thermocouples, Isolated Thermocouple Measurement, Thermocouple to Frequency, Thermocouple to 4to20 m A Temperature Transmitter, Isolated Multiplexing of Thermocouples

RTD's Interfacing: Single Op Amp Interface, using a Signal Conditioner, Bridge configuration using 3wire RTD, Linearizing RTD Circuits, Current Transmitters for RTD Outputs, RTD Based Precision controller

UNIT-III:

Semiconductor Temperature Sensors Interfacing: Thermistor Interfacing - Simple Interface Circuits, High-resolution Differential Thermometer, Current Transmitters, Thermistor to Frequency Conversion T to F Conversion using Diodes, Absolute Temperature to current Conversion, Temperature Control Circuits, Multiplexed Applications, Isolation, 4to20 m A Current Transmission

UNIT-IV:

Pressure and Force Transducers Interfacing: Pressure Transducer Interfacing - Strain Gauge Based Transducers, Potentiometer to Frequency Transducer, Interfacing High level Semiconductor Transducers, Isolated Pressure Transmitter, Pressure Control System

Force Transducer Interfacing: Spring Driven Rheostat, Strain gauge & Signal Conditioner, High Resolution Load Cell Platform, Interface, Strain Gauge to Frequency Conversion, Isolators & Transmitters

UNIT-V:

Flow Meters and Level Transducers Interfacing: Flow Meter Interfacing - Differential Pressure Flow meters, Frequency output Flowmeters, Anemometers, Hinged Vane, Flowmeter, Thermal Flow Meter, Transmission & Readout

Level Transducers Interfacing: Float & Potentiometer, Optical Sensing & Thermal Sensing

TEXT BOOKS:

1. Sensors and Signal Conditioning, Raman Pallas Areny, John G. Webster, 2nd Edition, John Wiley and Sons
2. Transducer Interfacing Handbook A Guide to Analog Signal Conditioning, Daniel H. Sheingold (Editor), Analog Devices Publications

REFERENCES:

1. Op Amp Applications Handbook, Walt Jung (Editor), Elsevier
2. Introduction to Instrumentation and Measurement, Robert B. Northrop, 2nd Edition, Taylor & Francis Group

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1LI03) PROCESS CONTROL INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basic characteristics of first order and higher order processes
- To acquire knowledge about the characteristics of various controller modes and methods of tuning of controllers
- To acquire knowledge on the construction, characteristics and application of control valves
- To understand multi variable systems and advanced control schemes
- To study the unit operations and a case study of distillation column control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the mathematical model for real-time first and higher order systems
CO-2: Design various controller modes with tuning
CO-3: Implement advanced control schemes for various processes
CO-4: Ability to Analyze Multivariable Systems and Multi-loop Control Schemes for various processes
CO-5: Ability to identify, formulate, and solve problems in the process control domain

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	2	2
CO-2	2	1	2	2	2	2
CO-3	2	1	2	2	2	2
CO-4	2	1	2	2	2	2
CO-5	2	1	3	2	2	2

UNIT-I:
Introduction: Need for process control, design aspects of process control system, process degrees of freedom. Mathematical model of first order processes: level, pressure and thermal processes, Second-order process: Interacting and non-interacting processes, State space modeling. Linearization of nonlinear systems.

UNIT-II:
Basic Single Loop Control Actions and Tuning, Characteristics and Dynamics of Discrete Control Modes: ON-OFF, Proportional, Pland P+I+D control modes.
Tuning of Controllers: Process reaction curve method, Ziegler Nichols method, Damped oscillation method, Evaluation criteria IAE, ISE, ITAE, Digital PID Algorithm. Dahlin's algorithm, deadbeat controller.

UNIT-III:

Mimo Systems: Multi Loop Controllers: Feed-forward control, ratio control- cascade control, adaptive split range control, multivariable control, Multi variable IMC- Model based Predictive Controller, examples from distillation column and boiler systems.

UNIT-IV:

Final Control Element: I/P converter pneumatic and electric actuators valve positioner control valves characteristics. Inherent and installed characteristics, control valve sizing cavitation and flashing, selection criteria.

UNIT-V:

Industrial Applications: Dynamics of Four tank system, CSTR, pH neutralization process Distillation column and Modern control practices in: Power plants, pharmaceuticals and petrochemicals industries.

TEXT BOOKS:

1. Chemical Process Control, G. Stephanopoulos, Prentice Hall of India, New Delhi, 1990
2. Process Control, Bela, Liptak
3. Process Control Instrumentation Technology, Curtis Johnson, Prentice Hall India

REFERENCES:

1. Process Control: Modeling, Design, and Simulation, B. Wayne Bequette, Prentice Hall of India, 2004
2. Process Control, Pollard A. Heinemann Educational Books, London, 1971

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI01) DATA ACQUISITION SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To identify the selection of type of data acquisition system
- To understand the principles of A/D, D/A Converters, Error Analysis, Display Systems
- To recognize these principles written in form of mathematical equations
- To apply these equations to analyze problems by making good assumptions and learn systematic engineering method to design a good Data acquisition system
- To apply fundamental principles of A/D's, D/A's, Data Acquisition Hardware & Software requirements for the solution of practical high-performance Data Acquisition system etc.

COURSEOUTCOMES: After completion of the course, the student should be able to

CO-1: Apply fundamental knowledge of mathematics to modeling and analysis of A/D & D/A's, error analysis on data acquisition systems

CO-2: Conduct case studies indifferent data acquisition systems and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports

CO-3: Understand the errors/problems by an improper design analysis in data acquisition system

CO-4: Interface the analog and digital acquisition systems with PC, Analyze and display the output

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	-	2	2	2
CO-2	2	1	-	1	2	3
CO-3	2	1	-	2	2	2
CO-4	2	1	-	2	2	2

UNIT-I:

Data Loggers and Data Acquisition Systems: Data acquisition systems-configurations components, analog multiplexes and sample and hold circuits specifications and design considerations. DACs: specifications characteristics, types of DACs (serial, parallel, direct and indirect). Hybrid and monolithic DACs. ADCs: specifications characteristics, types of ADCs (serial, parallel, direct and indirect). Hybrid and monolithic ADCs, sigma delta ADCs', Hybrid DAS Schematic diagram configurations specifications

UNIT-II:

Error Budget of DACs and ADCs: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS. Case study of a DAC and an ADC. 31

UNIT-III:

Data Acquisition Hardware and Software: Specifications of Hardware-IO analog signal range, gain for analog input and resolution in ADC converter, resolute\ion in DAC and counter chips, sampling frequency and maximum update rates, triggering capacity. Digital lines and ports, data acquisition VIs.

UNIT-IV:

Distributed and Standalone Data Logger: Introduction, methods of operation-programming and logging data using Express cards, standard alone operation-direct and remote connection to the host PC, stand alone logger/controller hardware interfaceRS232C, RS485 standard, communication bottlenecks and system performance, using Ethernet to connect data loggers

UNIT-V:

Analyzers: Spectrum Analyzers guidelines, various triggering techniques, different types of spectrum analyzers, Recorders. Display devices and Display systems, Logic Analyzers State and time referenced data capture. Scalar and Vector Network analyzers.

TEXT BOOKS:

1. Users Handbook of D/A & A/D Converters, E. R. Hnatek
2. Electronic Analog/Digital Converters, H. Schmid
3. Data Converters, G. B. Clayton

REFERENCES:

1. Electronic Instrumentation (ISTE Learning Material) (Ch:7) H. S. Kalsi, Learning Material Center, Indian Society of Technical Education, New Delhi
2. Electronic Instrumentation & Measurements, David A. Bell
3. Hand Book of Biomedical Instrumentation, Khandapur R. S., Tata McGraw Hill, 1996
4. Electronic Measurements, Oliver and Cage (ISE), McGraw Hill

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ES18) EMBEDDED SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To learn the general embedded system concepts
- To understand design of embedded hardware and software development tools
- To learn the basics of OS and RTOS
- To describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic requirements of embedded systems
CO-2: Identify the hardware to develop the Embedded System
CO-3: Apply the software tools for Real time Embedded Applications
CO-4: Analyze the RTOS concepts to develop the Embedded Applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	3	2	1
CO-2	2	2	2	2	3	3
CO-3	3	2	2	2	2	3
CO-4	3	1	2	2	3	3

UNIT–I:
Fundamentals of Embedded Systems: Embedded System-Definition, Characteristics, Design metrics, Classification of Embedded Systems, Real Time Systems - Need for Real-time systems, Hard and Soft Real-time systems, Processors in the system, Other Hardware units, Software components, Examples for embedded systems, Challenges in Embedded System Design.

UNIT–II:
Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors, Common memory devices - Memory selection, Watch dog timer, Serial Communication Protocols.

UNIT–III:
Embedded Software Development Environment: Embedded System Development Process, Programming languages, Software Development tools - Host and Target machines, Linkers/Locators for embedded software, getting embedded software into the target system, Testing on host machine.

UNIT–IV:

Real Time Operating Systems Concepts–I: Basics of Operating system, Need for RTOS in embedded system, GPOS versus RTOS, RTOS Architecture and Characteristics, Tasks and Task states, Task scheduling, Scheduling algorithms - Rate Monotonic, EDF, Round Robin, Round Robin with Interrupts, Priority driven – Preemptive and Nonpreemptive scheduling.

UNIT–V:

Real Time Operating Systems Concepts–II: Inter-Process Communication mechanisms – Semaphores, Message queues, Mailboxes, Pipes, Task Synchronization - Shared data - Priority Inversion - Inheritance and Ceiling, Dead lock, Memory management, Interrupt routines in RTOS environment, Device driver.

Design Examples and Case Studies: Case study of embedded system design and coding for Automatic Chocolate Vending machine using µCOS RTOS, Case study of Digital Camera Hardware and Software architecture.

TEXT BOOKS:

1. Embedded / Real Time Systems, Concepts, Design & Programming, Dr. K. V. V. K. K. Prasad
2. Embedded Systems Architecture, Programming and Design, Raj Kamal, 2nd Edition, Tata McGraw Hill, 2011
3. An Embedded Software Primer, David E. Simon, 1st Edition, Pearson,2005

REFERENCES:

1. Real time Systems, J. W. S. Liu, Pearson, 2009
2. Real-Time Embedded Systems: Design Principles and Engineering Practices, 1st Edition, Newnes, 2015
3. Computers as Components - Principles of Embedded Computing System Design, Wayne Wolf, 2nd Edition, Morgan Kaufmann Publisher, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI02) ROBOTICS AND CONTROL INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basic components of a Robot
- To learn different types of Robot sensors, grippers and actuators used in Robotics
- To acquire basic Knowledge on Robot kinematics
- To learn control techniques applied to robot manipulators
- To understand the fundamentals of robot programming

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots.
CO-2: Appreciate the usage of different sensors, grippers and actuators in Robotics
CO-3: Analyse the direct and the inverse kinematic problems.
CO-4: Analyze different controlling techniques used for robot manipulators
CO-5: Gain knowledge about different methods of robot programming

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	3	2	3
CO-2	3	1	2	3	3	3
CO-3	3	1	2	2	3	3
CO-4	2	1	2	2	3	3
CO-5	3	1	2	2	3	3

UNIT-I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT-II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT-III:

Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT-IV:

Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations

UNIT-V:

Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education
3. Industrial Robotics Technology, Programming and Applications, Mikell P. Groover, McGraw Hill, 2012

REFERENCES:

1. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C.S.G Lee, McGraw-Hill International Edition
2. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
3. Industrial Robotics, Technology programming and Applications, Mikell P Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI03) DIGITAL IMAGE PROCESSING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce fundamentals of digital image processing and study image transforms
- To learn enhancement & restoration techniques in spatial and frequency domains
- To study and compare various image compression image segmentation and Morphological algorithms
- To understand image analysis methods

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the basic principles of digital image processing and perform image transforms

CO-2: Understand and perform basic image processing methods such as Image filtering operations, Image enhancement and restoration

CO-3: Analyze and compare various image compression image segmentation and Morphological techniques and their applications

CO-4: Design and implement various algorithms for image analysis

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	2	2	2
CO-2	2	1	-	2	2	2
CO-3	3	1	-	3	3	2
CO-4	3	1	-	3	3	3

UNIT–I:

Fundamentals of Image Processing: Digital Image Fundamentals, Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels, Imaging Geometry.

Image Transforms: 2 D-Discrete Fourier Transform, Discrete Cosine Transform (DCT), Haar Transform, Hadmard Transform, Hotelling Transform and slant transform.

UNIT–II:

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency Domain Methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT–III:

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Edge Linking using Hough Transform, Thresholding, Region Based segmentation.

Wavelet Based Image Processing: Introduction to wavelet Transform, Continuous wavelet Transform, Discrete wavelet Transform, Filter banks, Wavelet based image segmentation.

UNIT–IV:

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models - Lossy and Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, JPEG Standards.

Image Restoration: Image Restoration Degradation model, Algebraic approach to restoration, Inverse Filtering, Least Mean square filters.

UNIT–V:

Morphological Image Processing: Dilation and Erosion, Opening and closing, The Hit or Miss Transformation, Morphological algorithms.

Representation and Description: Boundary following, chain codes, polygonal approximation using minimum - perimeter polygons, boundary segments, skeleton, simple boundary descriptors, shape number, simple regional descriptors.

TEXT BOOKS:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th Edition, Pearson, 2018
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, 5th Edition, TMH, 2015

REFERENCES:

1. Digital Image Processing, William K. Pratt, 3rd Edition, John Willey, 2007
2. Fundamentals of Digital Image Processing, A. K. Jain, 3rd Edition, PHI, 1989
3. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods and Steven L. Edding, 2nd Edition, TMH, 2010
4. Digital Image Processing and Computer Vision, Sonka, Hlavac, Boyl, Cengage Learning, 2008
5. Introduction to Image Processing and Analysis, John C. Russ, J. Christian Russ, CRC Press, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI04) POWER PLANT INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand and analyze the process of power generation. Measurement and controlling of different plant parameters
- To identify and innovate techniques for improving plant efficiency
- To analyze and identify pollutants in flue gases and industrial waste generated during the process of power generation
- To improve plant efficiency, reduce leakages and losses and use technologies for designing and developing pollutant free industrial environment

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate power generation techniques used in different types of power plants
CO-2: Understand measurements and control of various parameters in power plant
CO-3: Understand and standby the saying one watt saved is equal to two watts generated
CO-4: Understand the concepts of solar power generation

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	3	2	2
CO-2	1	1	2	3	2	2
CO-3	1	1	2	3	2	2
CO-4	1	1	2	3	2	2

UNIT-I:
An Overview of Power Generation: Brief survey of methods of power generation – Hydro, Thermal, Nuclear, Solar, Biomass, Geo-thermal, Wind - An outline of boilers – Feed water systems – Steam circuits – combustion process – Products of combustion process – Fuel systems – Treatment of flue gases – steam turbine – condensate systems – Alternators – feed water conditioning – Turbine bypass valves.

UNIT-II:
Parameters and their Measurement: Current Testing Equipment – Arnold Current Transformer Test Bridge, Petch Elliott Current Transformer Test Bridge, Voltage Testing Equipment – Arnold Bridge Modification, Petch Elliot Bridge Modification, Power factor Measurement and Compensation, Capacitive Compensation for Power Factor Control, Generator Frequency Measurement. Nonelectrical parameters – flow of feed

water, fuel, air and steam with correction factors for temperature – pressure – temperature – smoke density measurements – dust monitors

UNIT-III:

Control Loops and Interlocks in Boiler: Combustion control – Control of main header pressure, air-fuel ratio control – furnace draft and excessive air control, drum level (three element) control, main and reheat steam temperature control - burner tilting up, bypass damper, super heater, spray and gas re-circulation control – B.F.P re-circulation control – hot well and De-aerator level control – Pulverizer control – computers in power plant.

UNIT-IV:

Turbine Monitoring and Control: Instrumentation control points of View, Principal parts of steam turbines, Turbine Steam Inlet System – Inlet valve arrangements, inlet measurements, Governors, Turbine Measurements – Process Parameters, mechanical parameters, electrical parameters, Turbine control system – safety control systems, process control systems, Lubrication for turbo-alternator -Lubrication system, Controls in Lubrication system, Turbo-Alternator Cooling System – Lube Oil cooling system, Alternator/Generator cooling system.

Analyzers in Power Plant: Thermal conductivity type – Paramagnetic type Oxygen analyzer – Infrared type and trim analyzer – Spectrum analyzer – Hydrogen purity meter- Chromatography – pH meter – conductive cell – fuel analyzer – brief survey of pollution monitoring and control equipment.

Unit–V:

Solar Power: Solar Heating: Flat solar panels - Different technologies of thermal solar collectors- Selective coatings for collectors and glazing, Solar heating systems - Individual and collective solar water heaters- Combined solar systems for the heating of buildings

Power Stations: Concentric Solar Power Plants- Concentrating systems- Components for production of heat and conversion into electricity

Solar PV Conversion: The PV Cell - Crystalline Solar cells - Thin film solar cell, Module and Array, Equivalent Electrical circuit, Open circuit voltage and Short circuit current, I-V and P-V Curves, Array design - Sun angle - effect of Temperature - Sun tracking, PV system components

TEXT BOOKS:

1. Modern Power Station Practice, Vol. 6, British Electricity International Pergamon Press, London ,1992
2. Boiler Control Systems, David Lindlsey, McGraw Hill Book Company,1997
3. Power Station Instrumentation, Jervice M. J., Butterwortth Heinemann,1933

REFERENCES:

1. Renewable Energy Resources, Twidell & Wier, CRC Press (Taylor & Francis), 2016
2. Wind & Solar Power Systems, Mukund R. Patel, CRC Press, 2003
3. Standard Boiler Operations - Questions and Answers, Elonka S. M., and Kohal A. L., TMH, New Delhi, 1994
4. Power Plant Instrumentation, Prof. K. Krishna Swamy, Newage International
5. Powerplant Engineering, P. K. Nag, 3rd Edition, Tata McGraw-Hill Education, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI05) FIBRE OPTICS AND LASER INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the principles of optics and Lasers
- To apply the knowledge of Optics to fibers and understand the different industrial applications of Optical Fibers
- To learn the various applications of Lasers in Instrumentation
- To understand the Opto electronic components and their principles of operation along with their applications

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply fundamental knowledge of mathematics and Optics to design application specific optical fiber

CO-2: Apply Lasers in Instrumentation for the measurement of Pressure, temperature, Level and find the solutions for the errors if any

CO-3: Understand the advantages of using Lasers

CO-4: Apply opto- electronic components and lasers in Medical instrumentation

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	-	3	2	1
CO-2	3	2	-	2	3	2
CO-3	2	2	-	2	2	2
CO-4	3	2	-	3	2	2

UNIT–I:

Optical Fibers and their Properties: Introduction to Optical Fibers - principles of light propagation through a fiber Different type of fibers and their properties –Transmission characteristics of optical fiber –Absorption losses Scattering losses –Dispersion - source coupling, splicing and connectors, Fibre termination - advantages and disadvantages of optical fibers

UNIT-II:

Industrial Applications of Optical Fibers: Fiber optic sensors Fiber optic Instrumentation system - Interferometric method of measurement of length - Moiré fringes Measurement of pressure, temperature, current, voltage, liquid level and strain. Fiber optic gyroscope polarization maintaining fibers applications, Biomedical Applications Endoscopy.

UNIT-III:

Laser Fundamentals: Fundamental of Lasers Properties of Laser - Three level and four level lasers Laser modes Resonator configuration Q-switching and Mode locking Cavity damping Types of lasers: Gas lasers, Solid lasers, Liquid lasers Semiconductor lasers.

Laser Safety: Radiation hazards, maximum permissible exposure, classification, safety measures and Personal Protective Equipment (PPE)

UNIT-IV:

Industrial Applications of Lasers: Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect Material processing: Laser Heating, Welding, Melting, Cutting, Hole Drilling and Trimming of material Removal and vaporization.

UNIT-V:

Medical Applications of Lasers and Hologram: Medical Applications Lasers - Laser and Tissue interaction, Laser instruments for surgery - CO2 laser as bloodless scalpel, Removal of tumors of vocal cords, Brain surgery, Plastic surgery, Gynecology, Oncology, Dermatology and Ophthalmology. Holography Basic principle; methods (reflection, transmission, and hybrid), Holographic Components, Holographic Interferometry and Applications, Holography for Non-destructive Testing

TEXT BOOKS:

1. Optical Fiber Communication Principles and Practice, J. M. Senior, Prentice Hall of India, 2009
2. Introduction to Opto Electronics, J. Wilson and J. F. B. Hawkes, Prentice Hall of India, 2018
3. Lasers: Theory and Applications, Thyagarajan K. and Ghatak A. K., Plenum Press,2018

REFERENCES:

1. Understanding Fiber Optics, Jeff Hecht, 5th Edition, Prentice Hall,2015
2. Optical Fiber Communication, G. Keiser, McGraw Hill, 2003
3. Fiber Optic Sensors: An Introduction for Engineers and Scientists, Eric Udd, William B., and Spillman, Jr., John Wiley and Sons, 2011
4. Optical Fiber Communication and Sensors, M. Arumugam, Anuradha Agencies, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CP05) INTERNET OF THINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the terminology, technology, concept of M2M (machine to machine) and its applications
- To introduce the Python Scripting Language which issued in many IoT devices
- To introduce the IOT in different domains, system management with NETCONF-YANG
- To introduce the hardware and working principles of various sensors used for IoT
- To introduce the Raspberry PI platform, design and implementation of web application Frame work used in IoT applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the physical and logical design of the Internet of Things, IoT & M2M
CO-2: Analyze various applications of Internet of Things in various domain, NETCONF-YANG
CO-3: Create Logical Design of IoT Systems using Python
CO4: Understand the hardware and working principles of various sensors used for IoT,
CO5: Create Web Application framework design using Raspberry PI plat form and RESTful web API

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	2	2	3
CO-2	3	1	2	2	3	3
CO-3	1	1	2	2	2	3
CO-4	2	2	2	2	2	2
CO-5	1	2	3	3	2	2

UNIT–I:

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT –IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies –Wireless Sensor Networks, Cloud Computing, Bigdata analytics, Communication protocols, Embedded Systems, IoT Levels and Templates.
IOT and M2M: Introduction, M2M, Difference between IOT and M2M, SDN and NFV for IOT

UNIT–II:

Domain Specific IoTs: Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

System Management with NETCONF-YANG: Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG

UNIT – III:

Introduction to Python: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages -JSON,XML, HTTPLib, URLLib, SMTPLib

UNIT-IV:

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), and Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API

UNIT-V:

Controlling Hardware: Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, Using unipolar and bipolar Stepper motors

Digital input- Sensing push switch, pull-up and pull-down resistors, Rotary encoder, Using keypad, Using RTC Sensors: Light sensor, temperature sensor with thermistor, voltage sensor, ADC and ADC, Temperature and Humidity Sensor DHT11, Read Switch, Distance Measurement with ultrasound sensor

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and Solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

REFERENCES:

1. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, Wiley, 2014
2. The Internet of Things, Samuel Greengard, MIT Press, Cambridge, 2015
3. Internet of Things: Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufman, 2016

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI06) VLSI TECHNOLOGY AND DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To learn the fabrication process of Integrated Circuit and electrical properties of MOSFET
- To study the concepts of stick diagrams and layouts with the knowledge of MOS layers
- To understand the concept of scaling and its effects
- To learn the design of digital systems using subsystem design approach

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand IC Fabrication process steps required for various MOS circuits
CO-2: Know the various electrical properties of MOS transistors
CO-3: Design the digital circuits using various logic styles
CO-4: Implement subsystems with different technologies

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	-	-	-	-
CO-2	3	2	-	2	1	1
CO-3	2	2	-	2	1	1
CO-4	2	2	-	-	2	2

UNIT–I:
Introduction to MOS Technology: Introduction to VLSI design, Moore's Law, VLSI Design flow, Basic MOS Transistors, Operation of Enhancement and Depletion Mode Transistors, Fabrication Process: nMOS, pMOS, and CMOS fabrication. BiCMOS technology.

UNIT–II:
Basic Electrical Properties of MOS and Bicmos Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, Transconductance, and Output conductance, Figure of merit, Pass transistor, pull-up to pull-down ratio for nMOS inverter-driven through one or more pass transistors, NMOS Inverter, and Bi-CMOS Inverters.

UNIT–III:
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for nMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT–IV:

Combinational MOS Logic Circuits: CMOS logic gates - NOR and NAND gate, Realizing Boolean expressions using nMOS and CMOS gates, Stick diagrams and layouts for basic logic gates, CMOS full adder, Designing of logic circuits using Pass Transistor Logic (PTL) and CMOS Transmission Gates (Pass Gates)

UNIT–V:

Sequential MOS Logic Circuits: Behavior of bi-stable elements, static SR Latch circuit, Clocked latch and flip flop circuits, CMOS D-latch, and edge-triggered flip flop.
Subsystem Design: Adders, Multipliers, Multiplexer, Parity generator, Dynamic shift register, ALU subsystem, Comparator, Up/Down Counter.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Dougles and A. Pucknell, PHI Edition, 2005
2. CMOS Digital Integrated Circuits Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, 4th Edition, TMH, 2019

REFERENCES:

1. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E. Weste, David Harris, Ayan Banerjee, 4th Edition, Pearson, 2015
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective, Ming-BO Lin, CRC Press, 2011
3. Modern VLSI Design-IP-Based Design, Wayne Wolf, 4th Edition, Prentice Hall, 2015

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI07) ANALYTICAL INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To import basics of analytical instruments and methods
- To understand spectroscopic and chromatographic
- To introduce methods to Interpret and analyze data derive from any analytical instrument
- To familiarize with the principles and applications of electro chemical instruments, gas analyzers and radiation detectors

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Examine the relevant methods and techniques for different Analytical Parameters
CO-2: Demonstrate proficiency in using statistical methods for evaluating and interpreting data using spectroscopy, chromatography and gas analyzers
CO-3: Identify tools to apply principles of spectroscopy, chromatography and gas analyzers
CO-4: Apply analytical techniques for day to day and industrial applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	-	2	2	2
CO-2	2	2	-	1	2	2
CO-3	3	1	-	3	2	3
CO-4	2	1	-	2	2	2

UNIT–I:
Electrochemical Instruments: Basic concepts of Analytical Instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers, sodium analyzers, silica analyzers.

UNIT–II:
Absorption Spectroscopy: Concepts of Spectrometry, Beer- Lambert's law-Derivation of Beer Lamberts Law- Numerical exercises associated with the Law. UV, VIS spectrophotometers – single beam and double beam instruments – Instrumentation associated with the above spectrophotometers – sources and detectors.
IR Spectrometers: Sources and detector, Instrumentation associated with the above spectrophotometers, FTIR. Interpretation and Analysis. Emission Spectroscopy: Flame

emission and Atomic emission spectrophotometers – Sources for Flame Photometers, Online calorific value measurements.

UNIT–III:

Chromatography: Chromatography – types- Basic principles of gas chromatography, liquid chromatography (HPLC) ---- different types of columns, detectors, recorders and associated equipment for Gas and Liquid Chromatographs and their applications, Interpretation and Analysis.

UNIT–IV:

Nuclear Magnetic Resonance Spectrometry: Instrumentation associated with NMR spectrophotometer – Introduction to mass spectrophotometers, Introduction and Working Principle of Electron Spin Resonance (ESR), Interpretation and Analysis.

UNIT–V:

Gas Analyzers: Analysis using Thermal conductivity principle, Katharometer – oxygen analyzers using paramagnetic principle, H2S analyzer system, CO monitors, NOx analyzers, Industrial analyzer circuits, Pollution Monitoring systems

Thermal Analyzers and Nuclear Radiation Detectors: Differential Scanning Calorimetry (DSC), Derivative Thermo Gravimetric Analyzers (DTGA). Gas filled Detectors- GM counters, Scintillation counter, Ionization chamber, Proportional counter, solid state detector.

TEXT BOOKS:

1. Handbook of Analytical Instrumentation, R. S. Khandpur, TMH
2. Instrumental Method of Analysis, Willard H. H., Merrit L. L. Dean, D. VanNostrand, 6th Edition, CBS Publishing and Distributors, 1995

REFERENCES:

1. Process Measurement and Analysis, B. G. Liptak, CRC Press
2. Principles of Instrumental Analysis, Skoog D. A. and West D. M., Holt Sounder Publication, Philadelphia,1985
3. Instrument Technology, Jones B. E., Butterworth Scientific Publications, London, 1987

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1LI08) INSTRUMENTATION FOR AGRICULTURAL AND FOOD PROCESSING INDUSTRIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To know the necessity of instrumentation for food processing and agriculture
- To study the science behind soil analysis and working of related sensors
- To know the different industrial processes & instrumentation and control behind it
- To study green house effect and instrumentation to overcome the problem

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate need for instrumentation in food processing, agriculture, Packing and Greenhouses
CO-2: Analyze the soil condition and the environmental condition for seed growth
CO-3: Appreciate the instrumentation in food processing industries
CO-4: Appreciate the instrumentation in agricultural industries

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	2	2	2
CO-2	2	1	-	1	2	3
CO-3	2	1	-	2	2	2
CO-4	2	1	-	2	2	3

UNIT–I:
Introduction: Necessity of instrumentation and control for agricultural and food processing Industries.
Soil Science and Sensors: pH, conductivity, resistivity, temperature, soil moisture and salinity, ion concentration, measurements, methods of soil analysis. Instrumentation for environmental conditioning of seed germination and growth

UNIT–II:
Agrichemical Industries: Introduction, Pesticides, Insecticides, Plant-Growth Modifiers, Plant Nutrients and Regulators – flow diagram of fertilizer plant, sensors, and instrumentation set-up.

UNIT–III:
Greenhouses and Instrumentation: Ventilation, cooling and heating wind speed, temperature and humidity, rain gauge, carbon dioxide enrichment measurement and control. Leaf area, length, evapo-transpiration, temperature, wetness and

respiration measurement and data logging. Electromagnetic, radiation, photosynthesis, infrared and bio sensor methods in agriculture. Agro meteorological instrumentation weather stations.

UNIT–IV:

Food Processing: Introduction, Types of Food Processing- Refining & Milling, Canning, Concentration, Freezing, Drying, pasteurizations and sterilization, fermentation, irradiation, packaging, Flow diagrams and instrumentation set-up. Food Processing Equipment – Sanitary Design and Materials of construction, cleaning, controls.

UNIT–V:

Food Processing Industries: Sugar industries: Introduction, Manufacturing of Sugar-Cane, Cane-sugar refining, Decolorization -Char Filtration, Flow diagram of sugar plant, sensors and instrumentation set-up.

TEXT BOOKS:

1. Shreves Chemical Process Industries, George T. Austin, 5th Edition, McGraw Hill publications
2. Agricultural Processing and Food Engineering, Mukesh N. Dabhi & N. K. Dhamsania, 2010
3. Process Control Instrumentation Technology, Johnson C. D., 7th Edition, Pearson Education, New Delhi, 2003

REFERENCES:

1. Industrial Instrumentation, D. Patranabis, Tata McGraw Hill Publications, New Delhi
2. DMGH: Lesson 1 & 18, History, Types, Cooling, Shedding and Ventilation Systems of Greenhouse
3. Handbook of Agricultural Engineering, ICAR, 2012
4. Principles of Agricultural Engineering, Michael A. M., Volume 2, 2013
5. Manual on Instrumentation and Operations for Automatic Weather Stations for Agrometeorological

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2LI01) INSTRUMENTATION LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:
- To acquire hands on experience in active and passive sensors/transducers
- To understand different signal conditioners
- To design basic measuring devices like bridges

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the use of sensors
CO-2: Identify the sensors required for any specific application
CO-3: Design simple measuring devices
CO-4: Develop simple measuring systems employing appropriate sensors

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	-	3	3	3
CO-2	3	1	-	3	3	3
CO-3	3	1	-	3	2	3
CO-4	3	1	-	3	3	3

LIST OF EXPERIMENTS:

1. Measurement of Load using Strain Gauge Bridge
2. Measurement of Temperature using Thermistor, RTD and Thermocouple
3. Measurement of Displacement using LVDT
4. Pressure measurement through Bourdon Tube
5. Measurement of Flow
6. Measurement of RPM using opto-coupler and comparing it with stroboscope
7. Measurement of precision, Angular Velocity and RPM of a rotating Disk
8. Measurement of Velocity, Acceleration and Vibration using Piezo-electric transducer
9. Measurement of Humidity
10. Measurement of Density
11. Measurement of Viscosity of Edible Oil using Redwood Viscometer
12. Measurement of Viscosity of Crude Oil using Saybolt Viscometer
13. Characteristics of pH sensors
14. Radiation Measurement and optical Pyrometers
15. Characteristics of Opto-Electronic Transducers (Photo Transistor, Photo Diode and LDR)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2LI02) PROCESS CONTROL WITH PYTHON LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To identify and obtain process parameters of various processes in the prototype model
- To understand the working of actuators, converters, controllers and control valves.
- To acquire the working knowledge of different controller types, modes of control actions
- To understand tuning of controllers and control schemes
- To learn systematic engineering methodologies to solve practical process control problems with Python

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain hands on experience in working with pilot plants (Flow/Level/Temperature/ Pressure Control Loop(s))
CO-2: Get exposed to simulation tools such as PYTHON/MATLAB/LABVIEW
CO-3: Build dynamic models using the input-output data of a process using Python
CO-4: Get acquainted with PID implementation issues and be able to tune the PID controller
CO-5: Obtain servo and regulatory responses and be able to analyze and draw meaningful conclusions using Python

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	3	2	2
CO-2	3	1	2	-	1	2
CO-3	2	1	2	1	2	3
CO-4	1	1	2	1	2	2
CO-5	2	1	2	2	3	3

LIST OF EXPERIMENTS:

1. Development of mathematical models for linear first and higher order processes using Python / MATLAB.
2. Linearization of nonlinear system dynamics around stable and unstable operating conditions.
3. Optimization of process parameters of First/Second Order Plus Dead Time process through unconstrained and unconstrained optimization using Python / MATLAB.
4. Tuning of P/PI/PID control parameters in time domain.

5. Tuning of P/PI/PID control parameters in frequency domain.
6. Stability analysis in time and frequency domain using Python / MATLAB.
7. Design of Multi-loop controllers.
8. Design of Internal Model Control for processes with a variety of dynamic representation.
9. Design of Model Predictive Controller for nonlinear systems based on transfer function models.
10. Design considerations for control valves.
11. Temperature control process with PID Control Action.
12. Multi loop control systems for Flow-Level Process Station using Cascade Control.
13. Effect of ON-OFF, P, PI, PD and PID controller on Flow Process Dynamics.
14. Effect of ON-OFF, P, PI, PD and PID controller on Liquid Level Process Dynamics.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	1	-	1	-
CO-2	3	3	3	-	1	-
CO-3	1	3	2	-	2	-
CO-4	3	3	2	-	1	-
CO-5	3	3	3	-	1	-

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & Follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

CO-5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	-	-	-
CO-2	3	3	3	-	-	-
CO-3	2	3	3	-	-	-
CO-4	2	3	3	-	-	-
CO-5	2	3	3	-	-	-

UNIT – I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT – II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT – III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1LI04) PLC, SCADA PROGRAMMING AND THEIR APPLICATIONS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the concepts of PLC and SCADA and their application
- To understand PLC programming and data acquisition from real world
- To understand different types of protocols used in industries
- To understand the importance of supervisory control in various levels of industrial automation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the main functional units of PLC and be able to explain how they interact, different bus types
CO-2: Design logic using advanced functions of PLC
CO-3: Create networking between PLC's using standard protocols
CO-4: Provide simple solution for industry problems with PLC and SCADA

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	-	3	1
CO-2	2	2	1	2	2	2
CO-3	3	2	3	-	2	2
CO-4	1	2	2	2	-	3

UNIT-I:
Programmable Logic Controller (PLC) Basics: Definition, Overview of PLC systems, input/output modules, Power supplies and Isolators. Sourcing and Sinking.
Basic PLC Programming: Programming On-Off inputs/ outputs. Creating Ladder diagrams, Basic PLC functions, register basics, timer functions, counter functions. ladder logic programing of industrial applications.

UNIT-II:
PLC Intermediate and Advanced Functions: Arithmetic functions, Number comparison functions, Skip and MCR functions, data move functions. Utilizing digital bits, sequencer functions, Matrix functions. PLC Advanced functions: Analog PLC operation, PID Function, Networking of PLC

UNIT-III:

Application of PLC: Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating

UNIT-IV:

Hart and Field Bus Introduction: Evolution of signal standard –HART Communication Protocol Communication Modes –HART commands HART Field Controller Field Bus Architecture Basic requirement of field bus standard field bus topology, CAN bus, MOD bus, MOD bus plus protocol.

UNIT–V:

SCADA: Basic building blocks of computer control system SCADA MTU and RTU, Case studies on SCADA, SCADA, PLC and DCS Compared HMI Motor Drives.

TEXT BOOKS:

1. Programmable Logic Controllers Principles and Applications, John W. Webb, Ronald A. Reis, 4th Edition, Prentice Hall Inc.,1998
2. PC Based Instrumentation and Control ,Mike Tooley, 3rd Edition, Elsevier
3. PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation and Control, Kevin James, Elsevier

REFERENCES:

1. Programmable Logic Controllers: Programming Methods and Applications, John R. Hackworth and Frederick D. Hackworth Jr., PHI, 2003
2. Automating Manufacturing Systems with PLCs, Hugh Jack, Lulu.com, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1LI05) VIRTUAL INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the concepts of virtual Instrumentation
- To understand about how to interface sensors and actuators to a computer
- To understand data acquisition and instrument control
- To acquire knowledge on networking
- To gain knowledge on developing different applications in digital image processing, control system, signal processing, and in simulation

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Acquire knowledge on how virtual instrumentation can be applied for data acquisition and instrument control

CO-2: Identify salient traits of a virtual instrument and incorporate these traits in projects

CO-3: Analyze advanced LabVIEW concepts for various applications

CO-4: Acquire knowledge on developing different applications in Digital image processing control system, signal processing and in simulation systems using a computer, plug-in DAQ interfaces and bench level instruments

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	-	2	2	3
CO-2	2	-	-	2	2	3
CO-3	2	-	-	2	2	3
CO-4	2	-	-	3	3	3

UNIT-I:

Virtual Instrumentation: Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

UNIT-II:

VI Programming Techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT-III:

VI Chassis Requirements: Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. VISA and IVI. Application of Virtual Instrumentation: Instrument Control, Signal Measurement and generation: Data Acquisition.

UNIT-IV:

Advanced LabVIEW Data Concepts: Advanced file I/O, Configuring INI files, Calling code from other languages, Fitting Square Pegs into round holes.

Connectivity in LabVIEW: Lab VIEW web server, E-mailing data from Lab VIEW, Remote Panels, Self describing data, shared variables, talking to other programs and objects, talking to other computers, database, report generation.

UNIT-V:

Simulation of Systems: Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

TEXT BOOKS:

1. LabVIEW Graphical Programming, Gary Johnson, 2nd Edition, McGraw-Hill, 1997
2. LabVIEW for Everyone, Lisa K. Wells & Jeffrey Travis, Prentice Hall, 1997

REFERENCES:

1. PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Kevin James, Newnes, 2000
2. LabVIEW Advanced Programming Technique, Rick Bitter, 2nd Edition, CRC Press, 2005
3. Virtual Instrumentation using LabVIEW, Jovitha Jerome, 1st Edition, PHI, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1LI06) MEDICAL ELECTRONICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To identify and obtain biological parameters and their relationship
- To understand the principles of amplification involved in acquiring a bio signal
- To recognize these principles written inform of mathematical equations
- To apply these equations to analyze problems by making good assumptions and learn systematic engineering method and design robust amplifiers
- To apply fundamental principles of Medical Instrumentation for the solution of practical biological problems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply fundamental knowledge of mathematics mixed with electronics and use it for designing bio amplifiers

CO-2: Understand or become aware of artifacts caused by an incorrect diagnosis of the symptoms through sample data

CO-3: understanding the principles of therapentic devices and modern imaging techniques

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	-	2	2	3
CO-2	1	2	2	1	1	1
CO-3	2	2	3	2	2	2

UNIT-I:

Introduction to Biomedical Instrumentation: Bio Potentials - Resting and Action potentials. Electrodes - Different types of electrodes for ECG, EEG, EMG; Equivalent circuits for electrodes; General and Smart Sensors used in Biomedical engineering; Selection Criteria for Transducers and Electrodes for Bio Medical applications; Design of low noise isolation preamplifiers, Differential Amplifiers including Op. Amps and Instrumentation Amplifiers; Chopper amplifiers; Electrical safety - Grounding and isolation.

UNIT-II:

Electro-Physiological Measurements: Electro Cardiography (ECG), Electro Encephalography (EEG), Electromyography (EMG); Vector Cardiograph, Echocardiography, Phonocardiography (PCG), Electroretinography (ERG), Electrooculography (EOG).

UNIT-III:

Cardiac Instrumentation: Blood pressure and Blood flow measurement, Specification of ECG machine, Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electro mechanical activity of the heart.

UNIT-IV:

Assisting and Therapeutic Devices: Cardiac pacemakers, Defibrillators, Heat lung machine, Muscle stimulator–Limb Prosthetics, Diathermy. Introduction to artificial kidney, elements of audio and visual aids in Biomedicine, Blood flow meters, Ultra Sonography; Automated Drug injecting systems.

UNIT-V:

Modern Imaging Techniques: X-ray Machine, Computer tomography (CT), Magnetic resonance Imaging system, Ultrasonic Imaging system, Applications of Lasers in biomedicine. IR (Thermographic) Imaging and its diagnostic criteria.

TEXT BOOKS:

1. Hand Book of Biomedical Instrumentation, Khanpur R. S., Tata McGraw Hill, 1996
2. Biomedical Instrumentation and Measurements, Cromwell L., Prentice Hall of India, 1995
3. Application & Design of Medical Instrumentation, John G. Webster, John Wiley & Son

REFERENCES:

1. Feyman Lectures on Physics Vol. 2, Richard P. Feyman, Robert B. Leighton and Matahew Sands, Narosa Publications
2. Medical Imaging Systems, Albert Macovski, Prentice Hall
3. Principle of Applied Bio-medical Instrumentation, Geddes and Baker, John Wiley and Sons, 1975
4. Medical Instrumentation Applications and Design, Honghton, Miffince, Bosten

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI09) INDUSTRIAL AND POWER ELECTRONICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To make students understand the application of amplifiers in industries
- To make students understand the need and working of SCR
- To make students understand the need of different operation of SCR and their industrial applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the need of DC amplifiers, RPS and SMPS
CO-2: Appreciate the need for SCR at different firing angle
CO-3: Appreciate the working and applications of industrial timers
CO-4: Appreciate the working of electrodes and RF generators

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	2	1	1	-
CO-2	3	3	2	1	1	-
CO-3	3	3	3	1	1	-
CO-4	3	3	2	1	1	-

UNIT-I:
DC Amplifiers: Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT-II:
Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.
Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators—Current boosting.

UNIT-III:
SCR, Thyristor and its Applications: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and

F, Ratings of SCR. Static circuit breaker, Protection of SCR. Diac and Triac, Triacs Triggering modes, Firing Circuits, Commutation.

UNIT-IV:

Inverters and Chopper Circuits Inverters: Inverters-Classification, Single Phase inverters, Converters single phase Half wave and Full wave. Chopper circuits Principle, methods and Configurations, Design of power supplies and regulators.

UNIT-V:

Industrial Applications: Industrial timers -Classification, types, Electronic Timers Classification, RC and Digital timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control. High Frequency heating principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics Generation and Applications.

TEXT BOOKS:

1. Industrial and Power Electronics, G. K. Mithal and Maneesha Gupta, 19th Ed., Khanna Publishers, 2003
2. Integrated Electronics, J. Millman and C. C. Halkias, McGraw Hill, 1972

REFERENCES:

1. Electronic Devices and Circuits, Theodore H. Bogart, 6th Ed., Pearson Education, 2003
2. Thyristors and Applications, M. Rammurthy, East-West Press, 1977
3. Integrated Circuits and Semiconductor Devices, Deboo and Burroughs, ISE

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI10) INDUSTRIAL INTERNET Of THINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To give an overview of the Interconnection and Integration of the Physical World with Cyber Space
- To provide an insight into Design and Development of IOT application
- To learn logical and physical design methodologies
- To understand the protocols for IoT

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the knowledge of Internet principles and protocols to understand the architecture and specifications of a given network

CO-2: Design simple IoT applications using prototyping boards

CO-3: Select the appropriate protocol for a specific network implementation

CO-4: Identify the security level needed for a particular industrial IOT application

CO-5: Analyze the process data using cloud based process data management tools

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	1	1	1	-
CO-2	2	3	2	1	1	-
CO-3	3	2	1	2	1	-
CO-4	1	3	2	3	2	-
CO-5	1	3	3	2	2	-

UNIT-I:

Internet Principles: Definition and Characteristics - IoT enabling technologies – Levels of deployment – Domain specific IoTs - SDN and NFV for IoT – ISO/OSI model – MAC address and IP address - Overview of TCP/IP and UDP -Basics of DNS - Classes of IP addresses - Static and dynamic addressing –Salient features of IPV4 – Specifications of IPV6 and 6LoPAN.

UNIT-II:

Physical Design Methodologies: Requirements and Specifications – Device and Component Integration —Physical design using prototyping boards - Sensors and actuators, choice of processor, interfacing and networking.

UNIT-III:

Logical Design Methodologies: Logical Design – Open source platforms - Techniques for writing embedded code - Case studies and examples using Python programming and Arduino/Raspberry Pi prototyping boards – IoT application development using Wireless Sensor Networks - Single Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes

UNIT- IV:

Protocols and Clouds for IoT: Application layer protocols for IoT – MQTT and – Introduction to cloud storage models and communication APIs – Web application framework – Designing a web API – Web services - IoT device management

UNIT-V:

Industrial IoT and Security: Introduction to the Industrial Internet - Networked Control Systems – Network delay modeling - Architecture and design methodologies for developing IoT application for Networked Control Systems – Example using SCADA system - Software Design Concepts - Middleware IIOT platforms- securing the Industrial Internet- Introduction of Industry 4.0.

TEXT BOOKS:

1. Internet of Things A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press (India), 2015
2. Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, A Press, 2016

REFERENCES:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, John Wiley & Sons, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI11) NANO TECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the multidisciplinary nature of nanotechnology and its applications
- To outline various nanomaterials and methods to modify these materials for wide variety of applications
- To introduce instrumentation for nanoscale measurements
- To enumerate specific applications of nanotechnology to electronics and medicine

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Evaluate the design considerations for nanoscale materials, devices, and structures in a general variety of applications

CO-2: Gain theoretical knowledge to synthesize, modify, and characterize, and use nanomaterials for typical applications

CO-3: Appreciate the need for specialized metrology for nanoscale measurements and familiarize with various commonly used instruments for nanoscale measurements

CO-4: Identify the applications of nanotechnology to electronics

CO-5: Learn the advancements in the field of medicine due to the advent of nanotechnology

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	3	2	3
CO-2	2	1	3	2	1	1
CO-3	1	2	2	1	2	1
CO-4	2	1	1	2	1	2
CO-5	2	1	2	2	1	2

UNIT-I:

Introduction to Nanotechnology: Introduction & History: Overview of atomic physics; Chemistry of atoms and molecules; Overview of quantum mechanics; Feynman's perspective of nanoscience; Social impact of nanotechnology; Motivation, Top-down vs. Bottom-up approaches Applications: Electronics, instrumentation, medicine, environmental sciences. Considerations: Size constraints on measurements; Optical, Electronic, and Magnetic Properties at Nanoscale.

UNIT-II:

Nanomaterials: Introduction to Nanomaterials: Metal Nanomaterials, Semiconductor nanomaterials, Quantum Dots, Quantum Wells, 2-terminal Quantum Wires, Bucky balls, Carbon Nanotubes, Nano Peapods, Nano Rods, Polymer-based Nanostructures, Gold **Nanostructures:** Nano-rods, Nano-cages, Nano-shells; Aerogels and porous materials for nanoscience applications, Nano-powders and Nanocrystal line Powders, Dendrimers.

UNIT-III:

Nanofabrication: Fabrication Techniques: Top-down approach Nanolithography, CVD and Metal-Oxide CVD (MOCVD); Bottom-up approach sol-gel process, chemical synthesis, wet deposition techniques, RF sputtering, Self-assembly and Layer-by-layer assembly (LbL).

UNIT-IV:

Nanoscale Measurements: Instrumentation: Principle of working, Operational aspects, Limitations, and Applications for: SEM, TEM, STM, SPM, AFM, Fluorescence microscopy; X-ray techniques: X-ray Diffraction (XRD), X-ray Absorption Spectroscopy, Small-angle X-ray scattering.

UNIT-V:

Nano Electronics Overview: Materials: Graphene, Boron Nitride Nano-mesh, III-V compounds: GaAs, GaN, AlGaN, In GaAs, High-K/Metal-Gate applications for non-Si **Nano Electronics Devices:** Silicon nanowires, Single- and Multi-Walled Carbon Nanotubes, III-V Quantum Wells, Ballistic deflection transistors (BDT) Applications: Printed electronics, Molecular electronics, Spintronics, Nano Optoelectronics: displays, Memory devices, Electronics modelled after living systems.

TEXT BOOKS:

1. Introduction to Nanotechnology, Poole C., Owens F., Wiley, 2007 (ISBN: 978,8126510993)
2. Nano Science and Nanotechnology: Fundamentals to Frontiers, Ramachandra M. S., Singh S., Wiley India Pvt. Ltd., 2013 (ISBN: 978,8126542017)
3. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, Pradeep T., McGraw-Hill India, 2007 (ISBN: 978,0070617889)

REFERENCES:

1. Springer Handbook of Nanotechnology, Bhushan B. (Ed.), Springer, 2006 (ISBN: 978,3540298557)
2. Nanotechnology: Basic Calculations for Engineers and Scientists, Theodore L., Wiley India Pvt. Ltd., 2011 (ISBN: 978,8126529667)
3. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, Varghese, T., Balakrishna K. M., Atlantic, 2012 (ISBN: 978,8126916382)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI12) NEURAL NETWORKS AND FUZZY SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To cater the knowledge of neural networks and fuzzy logic control and use these for controlling real time systems
- To expose the students to the concepts of feed forward Neural Networks and about feed back neural networks
- To teach about the concepts of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of feed forward neural networks
CO-2: Acquire adequate knowledge about feedback neural networks
CO-3: Acquire the concept of fuzziness involved in various systems
CO-4: Acquire knowledge about fuzzy set theory

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	-	2	2	2
CO-2	2	-	-	1	1	1
CO-3	2	-	-	1	2	2
CO-4	2	-	-	1	2	2

UNIT-I:

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT-II:

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron

Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

UNIT-III:

Multilayer Feed Forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture,

BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT -IV:

Self-Organizing Maps (SOM) And Adaptive Resonance Theory (ART): Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT-V:

Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Applications:

Neural Network Applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.

Fuzzy Logic Applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic Algorithms: Synthesis and Applications, Rajasekharan and Rai, PHI Publication
2. Introduction to Artificial Neural Systems, Jacek M. Zuarda, Jaico Publishing, 1997
3. Laurene Fausett, Fundamentals of Neural Networks-Architectures, Algorithms and Applications, Pearson Education Inc., 2008

REFERENCES:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Networks: Algorithms, Applications, J. A. Freeman and D. M. Skapura
3. Programming Techniques, 1st Edition, Pearson Education, 2007
4. Neural Networks and Learning Machines, Simon Haykin, MacMillen College Pub co., New York, 2011
5. Neural Networks and Fuzzy Logic System, Bork Kosko, PHI Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI13) POLLUTION CONTROL IN PROCESS INDUSTRIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To identify the different pollutants that cause serious problems in industries
- To understand the causes of pollutions from various emission reactions
- To recognize the origin of hazardous pollution gases in environment
- Treatment methods of specific pollutant arising out of industrial process

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Plan strategies to control and reduce pollution
CO-2: Select the most appropriate technique to control and treat industrial pollution
CO-3: Apply environmental management systems (EMS) to an industrial activity
CO-4: Design and develop anti-pollution monitoring systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	2	3	2	2
CO-2	3	3	1	3	3	2
CO-3	2	2	3	1	3	2
CO-4	2	3	2	3	3	3

UNIT-I:
Industrial Pollution Emissions and Indian Standards: Introduction-Man and environment, types of pollution, pollution control aspects, Industrial emissions-Gases, and Industrial emissions Liquids-water quality management in India.

UNIT-II:
Analysis of Pollutants: Industrial waste water analysis, industrial gaseous effluent analysis, particle size distribution, water quality regulations and policy development, water quality standards.

UNIT-III:
Pollution Control for Specific Pollutants-I: Removals of BOD-biological oxidation-anaerobic treatment-Removal of Chromium-control methods, reduction precipitation, Ion exchange, reverse osmosis-lime coagulation and adsorption.

UNIT-IV:
Pollution Control for Specific Pollutants-II: Removal of mercury-measurement of mercury- mercury losses in chlor-alkali industries-removal of mercury from gaseous

streams-removal of mercury from liquid streams. Removal of oxides of nitrogen-introduction-analysis of NOx control measures.

UNIT-V:

Pollution Control Aspects in Process Industries: Pollution control in chemical industries-pollution control aspects of fertilizer industries-ammonia plant effluents, ammonium sulphate plant-phosphoric acid plant-complex fertilizer plant.

Pollution Control in Petroleum Refineries and Petrochemical Units: Characteristics of liquid effluent-refinery liquid waste-treatment methods-treatment of liquid effluents from petrochemical industries-air pollution control-pollution control in pulp and paper industries.

TEXT BOOKS:

1. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw Hill Edition
2. Water Quality Concepts, Sampling, and Analyses, Yuncong Li, Kati Migliaccio, 1st Edition, CRC Press, 2010

REFERENCES:

1. Industrial Pollution Prevention Handbook, Harry M. Freeman, McGraw Hill Education, 2017
2. Industrial Pollution - A Reference to Small Scale Industries, N. Saradha, N. Dhulasi Birundha, 1st Edition, Serials Publications, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI14) PROCESS DATA ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To experimental design
- To linear regression analysis
- To linear Model Selection and Regularization Classification
- To process identification, performance monitoring and soft sensor design

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply Design of Experiments for Problem solving and Process Troubleshooting
CO-2: Select the right choice of regression method for a given application
CO-3: Select the right choice of classification method for a given application
CO-4: Systematically carryout System Identification, Process & Performance Monitoring
CO-5: Cohesively analyze alarm data, process data and process connectivity information

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	-	1	2
CO-2	2	3	3	-	3	1
CO-3	2	-	1	2	2	2
CO-4	-	-	3	-	2	2
CO-5	2	1	3	2	-	3

UNIT-I:
Introduction: Introduction to Process data analytics and Statistical learning - Review of Linear Algebra Concepts – Review of Probability & Statistics - Design of experiments - Industrial case studies on factorial experiments.

UNIT-II:
Regression: Linear Regression:- Simple Linear Regression, Multiple Linear Regression - K-nearest neighbors regression – Practical Consideration in the Regression Model - Validation methods to assess model quality:-The validation set approach, Leave-One-Out Cross Validation, k-Fold Cross Validation – Bias-variance Trade-off for k-Fold Cross Validation.

UNIT-III:

Linear Model Selection & Regularization: Subset Selection: - Best Subset Selection, Step-wise Selection and Choosing the Optimal Model – Shrinkage Methods: - LASSO, Ridge regression, Elastic nets – Dimension reduction Methods:- Principal Components Regression, Partial Least Squares.

UNIT- IV:

Supervised Learning with Regression and Classification Techniques: Logistic regression– Linear Discriminant Analysis - Quadratic Discriminant Analysis – Regression & Classification Trees – Support Vector Machines - Random forests, Bagging and boosting -Deep Learning.

UNIT-V :

Applications: Process data analysis for system identification (under open and closed loops) - Controller Performance Monitoring - Principal components analysis (PCA) for Process Monitoring and Partial Least Squares (PLS) for soft-sensor design - Data-based causality analysis for identification of process topology.

TEXT BOOKS:

1. An Introduction to Statistical Learning with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer Texts in Statistics, 2013
2. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2013
3. Data Analytics: Models and Algorithms for Intelligent Data Analysis, Thomas A. Runkler, 2nd Edition, Springer Vieweg, 2016

REFERENCES:

1. Principles of System Identification – Theory and Practice, Arun K. Tangirala, CRC Press, 2018
2. Performance Assessment of Control Loops: Theory and Applications, Huang B. and Shah S. L., Springer-Verlag,2007
3. Capturing Connectivity and Causality in Complex Industrial Processes, Fan Yang, Ping Duan, Sirish L Shah, Tongwen Chen, Springer, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI15) INDUSTRIAL DATA COMMUNICATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To provide an overview of the Industrial data communications systems
- To provide a fundamental understanding of common principles, various standards, protocols
- To provide insight into some of the new principles those are evolving for future networks

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Differentiate various types of industrial data network standards and the associated protocols based on their specifications and applications

CO-2: Analyze the various characteristics of each layer of the protocol stack pertaining to different Industrial data network standards

CO-3: Compare the performance of the standards and infer the advantages and drawbacks of each for a given industrial application

CO-4: Select and use the most appropriate networking technologies and standards for a given application

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	1	1	-
CO-2	2	3	3	2	2	-
CO-3	1	1	2	1	1	-
CO-4	2	1	3	2	3	-

UNIT-I:

Data Network Fundamentals: ISO/OSI Reference model - TCP/IP Protocol Stack- EIA 232 interface standard – EIA 485 interface standard - Media access protocol: Command/response, CSMA/CD — IEEE 802.3 Ethernet standard Bridges –Routers – TCP/IP - Gateways – Standard ETHERNET Configuration

UNIT-II:

Modbus and Hart Evolution of Industrial Data Communication Standards - MODBUS:- Protocol structure, Function codes - HART communication protocol, Communication modes, HART Networks, HART commands, HART applications & Troubleshooting

UNIT-III:

Profibus and Ff Fieldbus: Fieldbus architecture, Basic requirements of Fieldbus standard, Fieldbus topology, Interoperability and Interchangeability. Introduction – Profibus protocol stack – Profibus communication model – Communication objects – Foundation fieldbus versus Profibus Profibus – Dp, Profibus – Tp,

UNIT- IV:

AS – Interface (AS-I), Devicenet and Industrial Ethernet as Interface: Introduction – Physical layer – Data link layer – Operating characteristics. Devicenet: Introduction – Physical layer – Data link layer and Application layer. CSMA/CD Algorithm

Industrial Ethernet: Introduction – 10Mbps Ethernet – 100Mbps Ethernet- Gigabit Ethernet

UNIT- V:

Wireless Communication: Wireless sensor networks: Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless MAC Standards– IEEE 802.11- IEEE 802.15.4 – Zigbee, Wireless HART – ISA100 – Introduction to Industrial IOT.

TEXT BOOKS

1. Industrial Data Communications, Lawrence (Larry) M. Thompson and Tim Shaw, 5th Edition, ISA Press, 2015
2. NPTEL Lecture notes on, Computer Networks, Department of Electrical Engg., IIT Kharagpur

REFERENCES:

1. HART Application Guide, Bowden R., HART Communication Foundation, 1999
2. Field Buses for Process Control: Engineering, Operation, and Maintenance, Berge J., ISA Press, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI16) MICRO ELECTRO-MECHANICAL SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To obtain knowledge about present MEMS device and their application
- To understand the principal laws of physics and chemistry that apply in fabricating a MEMS device
- To understand different fabrication techniques like micro-machining, etching
- To apply these techniques and understand some practical models and their working
- To study the electronic interface and software design tools for MEMS devices

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand scaling issues of MEMS based on fundamental knowledge of physics

CO-2: Apply various micro manufacturing techniques to fabricate MEMS devices

CO-3: Apply techniques of additive manufacturing to MEMS

CO-4: Realize the need for advancement of technology towards microsystems for better living in the society

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	1	1	-
CO-2	2	3	3	1	1	-
CO-3	2	2	2	2	1	-
CO-4	1	1	3	2	1	-

UNIT-I:

Fundamentals of MEMS, Overview of MEMS and Microsystems: Evolution of microfabrication; Applications of MEMS in optical devices (Micro-Opto-Electro-Mechanical Systems or MOEMS), healthcare and biomedicine (including Bio-MEMS and Bio-MOEMS), aerospace, telecommunications, consumer products, automotive, and industrial products; Working principles of microsystems: Micro sensors acoustic wave, bio-, chemical, optical, pressure, thermal; Micro actuation thermal, shape-memory alloys, piezoelectric, electrostatic; MEMS devices Micro grippers; Micro motors; Microfluidics Micro pumps, Micro valves; Micro accelerometers.

UNIT-II:

Materials for MEMS and Microsystems: Substrates and Wafers; Silicon as a Substrate, Silicon Compounds, Silicon piezo resistors, Non-silicon based materials: Gallium Arsenide, Gallium Nitride, Quartz, Piezoelectric Crystals, Polymers.

UNIT-III:

Basics of Micro-Manufacturing: Photolithography; Cleanroom Environment; Deposition techniques: Ion implantation, Diffusion, Vapour Deposition (PVD, CVD, PECVD), Oxidation, Epitaxial growth; Etching techniques: Chemical (Wet) Etching, Plasma (Dry) Etching Design considerations; Process Design; Photomask layout using CAD; Mechanical design overview.

UNIT-IV:

Fabrication of MEMS: Bulk micromachining, Surface micromachining, LIGA Process, Deep X-ray Lithography (DXRL)

UNIT-V:

Characterization Of MEMS: Characterization techniques: Principle of working and operation of: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), X-Ray Diffraction (XRD), Optical microscope.

TEXT BOOKS

1. MEMS and Microsystems Design and Manufacture, Tai-Ran Hsu, Tata McGraw Hill, 2002
2. MEMS, N. Mahalik, McGraw-Hill Education, 2007

REFERENCES:

1. Fundamentals of Microfabrication: The Science of Miniaturization, Marc J. Madou, CRC Press, 2002
2. Microsystem Design, Stephen D. Senturia, Springer, 2004 CURRICULUM 41
3. Practical MEMS, Ville Kaajakari, Small Gear Publishing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI17) INSTRUMENTATION IN PAPER AND PULP INDUSTRIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To identify the different paper making processes and the differences between them
- To understand the principles of measurement of moisture, basic weight, caliper, brightness, Consistency, pH, ORP etc.
- To recognize these principles written in form of mathematical equations
- To apply these equations to analyze measurement of different parameters by making good assumptions and learn systematic engineering method to solve practical problems
- To apply fundamental principles of paper measurements for the solution of practical analysis of moisture, basic weight, caliper, brightness, Consistency, pH, ORP etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply fundamental knowledge of mathematics to modelling and analysis of moisture, basic weight, caliper, brightness, Consistency, pH, ORP in pulp and paper industries

CO-2: Conduct company visits and field study in different industries and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports

CO-3: Understand measurement of different parameters caused by an incorrect analysis in engineering system

CO-4: Understand the Paper Process methodology and instrumentation involved

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	2	2	2	2
CO-2	2	-	2	2	2	2
CO-3	2	-	2	2	2	2
CO-4	2	-	2	2	2	2

UNIT-I:

An Overview of Paper Making Process: Paper making process, Raw materials, Pulp separation, screening, Bleaching, Cooking, Chemical reaction, chippers, types of digesters, H factor and Kappa factors, Stock preparation, Instrumentation needs, Energy conservation and paper quality control.

UNIT-II:

Paper Properties and its Measurement: Physical, electrical, optical and chemical properties of paper, Basic weight, thickness, density, porosity, smoothness, softness, hardness and compressibility, stress, strain relationship, Tensile strength, bursting strength, tearing resistance, folding endurance, stiffness and impact strength, Dielectric constant, dielectric strength, dielectric loss and Properties of electrical insulating paper, Brightness, colour, gloss and capacity, Starch constant acidity and pH Measurement techniques.

Consistency Measurement: Definition of consistency, Techniques for head box consistency measurement, Stock consistency measurement and control.

UNIT-III:

Paper Making Machine: Functioning of Paper making machine, Quality parameters moisture, basic weight, caliper, brightness, colour, ash content, strength, gloss and tensile strength- parameters monitoring Instrumentation.

UNIT-IV:

Wet End Instrumentation: Conventional measurements at wet end – pressure vacuum, temperature, liquid density, specific gravity level flow; consistency measurement, pH, ORP measurement freeness measurement, Dry End Instrumentation, Conventional measurements-moisture, basis weight caliper, coat thickness, optical variables, measurement of length speed Digester, Rotary, Batch type

UNIT-V:

Pumps and Control Valves: Flow box - wet end variables - evaporator feedback - feed forward control - lime mud density control, stock proportioning system, refiner control instrumentation, basic pulper instrumentation-headbox rush/drag control - instrumentation for size preparation, coating preparation, coating weight control batch digester- k/kappa number control - bleach plant chlorine stage control, Control Aspects - Machine and cross direction control technique - consistency, moisture and basic weight control - dryer control – computer based control systems - mill wide control.

TEXT BOOKS:

1. Pulp and Paper Industries-Technology and Instrumentation, Sankaranarayanan P. E., Kotharis Desk Book Series, 1995
2. Handbook of Pulp and Paper Technology, Britt K. W., Van Nostrand Reinbold Company, 1970
3. Shreve's Chemical Process Industries, Austin G. T., McGraw Hill International Student Edition, 1985

REFERENCES:

1. An Introduction to Paper Industry Instrumentation, John R. Lavigne, Miller Freeman Publications, 1985
2. Measurement and Control in Paper Making, Robert J. McGill, Adam Hilger, 1980
3. Instrumentation Applications for the Pulp and Paper Industry, John R. Lavigne, Miller Freeman Publications, 1990
4. Instrument Engineers Handbook, Volume 2, Process Control, Liptak B. G., 3rd Edition, CRC Press, 1995
5. Pulp and Paper Chemistry and Chemical Technology, James P. Casey, John Wiley and Sons, 1981

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1LI18) INSTRUMENTATION FOR PHARMACEUTICAL INDUSTRY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To learn the sequence of operations in pharmaceutical industry
- To know the necessity of precision instrumentation in pharmaceutical industry
- To study the different processes that are performed in pharmaceutical industry
- To know the different components and equipment required to processes and control various parameters in pharmaceutical industry

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Identify and interpret various filters and centrifuge devices in pharmaceutical process applications

CO-2: Analyze the instrumentation for crystallization, vaporization and distillation process in pharmaceutical process applications

CO-3: Analyze the procedure to control humidity and refrigeration, crystallization and vaporization

CO-4: Interpret different methods and devices used for size reduction, separation and homogenization in pharmaceutical process applications

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	3	2	1
CO-2	2	2	3	3	2	1
CO-3	3	2	1	2	2	2
CO-4	3	1	2	3	2	2

UNIT–I:

Industrial Processing and Basic Principles: Unit Operations, Unit Processes, Scientific foundations. Filtration: Classification of Filtration, Mechanism of Filtration, filtration equipment, filter presses, Leaf filters, stacked disc filters, meta filters, Rotary continuous filters, factors affecting the rate of filtration.

Centrifugation: General principles, theoretical aspects, classification, Laboratory equipment, Large scale equipment, equipment with non-perforated basket, de laval clarifier, vertical solid bowl centrifuges, continuous centrifuges.

UNIT–II:

Crystallization: Introduction, Crystal forms and crystal Habit, classification of crystallizers, tank crystallizers, agitated batch crystallizers, Swenson Walker Crystallizer,

Krystal Crystallizer, Vacuum Crystallizer without External Classifying seed Bed, theoretical aspects of Crystallization, theory of Crystallization. Caking of crystals.

UNIT–III:

Evaporation and Distillation Heat Processes:

Evaporation: Introduction, classification of evaporators, steam jacketed kettle, Horizontal tube evaporator, short tube vertical evaporator, Long tube vertical evaporator, Forced circulation evaporator, Factors to be considered for the selection of evaporator

Distillation: Introduction, methods of distillation. Equipment of simple distillation-vacuum and fractional distillation.

Humidity Control Refrigeration:

Humidity: Basic concepts and definition, wet bulb temperature, adiabatic cooling lines, determination of humidity, air conditioning, humidification and humidifying equipment, dehumidifiers.

Refrigeration: Introduction, refrigeration equipment, coefficient of performance and refrigerants, Brine systems, refrigeration load.

UNIT–IV:

Size Reduction and Separation: Size Reduction: Introduction, mechanism and principles of size reduction, classification of size reduction equipment, law of size reduction, large equipment, mills using impact force for size reduction, cage mills, pin mills, fluid energy or jet mills, attrition and grinding mills tumbling mills. Ball mills and tube mills, practical size classifiers used with grinding mills, wet classifiers, non-rotary ball and bead mills

Size Separation: Testing Sieves, Screening equipment, factors to be considered for screening equipment.

UNIT–V:

Mixing and Homogenization: Introduction, equipment for mixing of miscible liquids, mixing of a soluble solid with a low viscous liquid etc., mixing solids with solids, equipment, consideration while choosing solids mixing equipment, mixing solids with liquids, mixing miscible liquids, mixing viscous masses, mixing of immiscible liquids, equipment for emulsification.

TEXT BOOKS:

1. Pharmaceutical Engineering, K. Samba Murthy
2. Pharmaceutical Engineering C. V. S. Subhramanyam
3. Tutorial Pharmacy, S. J. Carter, Cooper and Gunn's, 6th Edition, CBS Publisher, Delhi

REFERENCES:

1. Perry's Handbook of Chemical Engineering
2. Unit Operations, McCabe & Smith

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2LI03) INDUSTRIAL PROCESS CONTROL AND AUTOMATION LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To give a novice an understanding of PLC programming, ladder logic and the workings of a PLC modules
- To learn the difference between digital and analog signals and how to bring them into a PLC, process them, and send them back out
- To understand the role of each components (RTU, HMI & Drives) of automation in industry
- To understand the importance of data acquisition and management

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore basic, standard control techniques for things like Human Oriented Automation (HOA) control, level control, pressure control, and PID control loops
CO-2: Be introduced to HMI development and given a general understanding of how an HMI program works
CO-3: Learn the applications of SCADA software, SCADA features, creating applications, creating database tags, developing graphic displays, trending, communication with PLC and other hardware
CO-4: Design, Develop and Commissioning of PLC, RTU, Drives and SCADA programs for desired applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	2	3	2
CO-2	3	2	3	2	3	2
CO-3	3	2	3	2	3	3
CO-4	3	2	3	2	3	3

LIST OF EXPERIMENTS:

1. Design and development of ladder logic programming for switching
2. applications in PLC
3. Implementing Timers and Counters for industrial applications using ladder
4. logic programming
5. Interfacing, signal processing & normalization of analog signals to PLC
6. Interfacing, networking & monitoring of PLC's using SCADA
7. Control of level process station with PLC and data logging
8. Control flow process station with PLC and data logging

9. Control of pressure process station with PLC and data logging
10. Implementing Distributed Control System (DCS) using PLC and RTU for
    a. remote monitoring and control
11. Design and Development of SCADA system, with PLC Integration
12. HMI development for industrial application
13. Speed control of 3 phase induction motor using PLC through VFD
14. SCADA, PLC technology integration for multi process station monitoring and control

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2LI04) VIRTUAL INSTRUMENTATION LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To understand the control of an external measuring device by Interfacing a computer
- To familiarize image processing applications
- To learn to develop the control system and signal simulation applications
- To learn DSP application

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Design and Implement Data acquisition and control sequences using the LabVIEW software

CO-2: Perform experiments on circuits to determine their frequency response and characteristics of components etc. (using NI Elvis)

CO-3: Perform the image processing techniques on images using Vision Assistant module

CO-4: Develop the control system and signal simulation applications using CDSM and DSP toolkit

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	3	3	3
CO-2	3	2	2	2	3	3
CO-3	3	2	2	2	3	3
CO-4	3	2	2	2	3	3

LIST OF EXPERIMENTS:

1. Design of Decimal Counter Using Lab VIEW
2. Design of A function generator using Lab VIEW
3. Design of Filters Using NIELVIS
4. Signal processing with speed 33 (speech recording and analysis)
5. Image Processing techniques with Vision Assistant
6. Image Processing application with vision assistant
7. Image corrupted with salt and pepper noise, apply average local 3 X 3 filter, local average 5 X 5, local average 7 X 7 and median filter observe the response using Vision Assistant
8. Building and Configuring Simulations (Control Design and Simulation Module)
9. Modularizing the Simulation Diagram (Control Design and Simulation Module)

10. Trimming and Linearizing Nonlinear Models
11. Executing Simulations in Real Time
12. Interfacing with DAQ

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4LI02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1						
CO-2						
CO-3						
CO-4						

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry,

Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI19) INSTRUMENTATION SYSTEM DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To impart knowledge on the design of signal conditioning circuits for the measurement of Level, temperature and pH
- To develop the skills needed to design, fabricate and test Analog/ Digital PID controller, Data Loggers and Alarm Annunciator
- To make the students familiarize with regard to orifice sizing and control valve sizing.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Competence to design signal conditioning circuits for temperature sensors, V/I and I/V converters
CO-2: Design, fabricate and test smart transmitters
CO-3: Design, fabricate and test PID controllers
CO-4: Carry out orifice and control valve sizing for Liquid/Steam Services
CO-5: Expose to simulation tools such as MATLAB

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	1	1	3
CO-2	2	-	1	3	2	1
CO-3	1	3	3	2	2	2
CO-4	2	-	2	-	1	3
CO-5	-	2	2	2	3	-

UNIT-I:
Design of Signal Conditioning Circuits: Design of V/I Converter and I/V Converter- Analog and Digital filter design and Adaptive filter design – Signal conditioning circuit for pH measurement, Air-purge Level Measurement – Signal conditioning circuit for Temperature measurement: Thermocouple, RTD and Thermistor - Cold Junction Compensation and Linearization: – Software and Hardware approaches.

UNIT-II:
Design of Transmitters: Design of 2 wire and 4 wire transmitters: –RTD based Temperature Transmitter, Thermocouple based Temperature Transmitter, Capacitance based Level Transmitter, Smart Flow Transmitters and IoT enabled transmitters.

UNIT-III:

Design of Data Logger and PID Controller: Micro - controller based Data Logger - Design of PC based Data Acquisition Cards - Design of ON / OFF Controller using Analog Circuits - Electronic PID Controller - Microcontroller Based PID Controller.

UNIT IV:

Design of Alarm and Annunciation Circuit: Alarm and Annunciation circuits using Analog and Digital Circuits – Design of Programmable Logic Controller - Design of configurable sequential controller using PLDs.

UNIT-V:

Control Panel Design: Types of control panels, enclosure design guidelines grounding & shielding techniques, Electrostatic discharge (ESD), noise. design guidelines of control panel. Applications of control panel

TEXT BOOKS:

1. Process Control Instrumentation Technology, C. D. Johnson, 8th Edition, Prentice Hall, 2014
2. Control Valve Handbook, Emerson Process Management, 4th Edition, Fisher Controls International, 2005

REFERENCES:

1. Flow Measurement Engineering Handbook, R. W. Miller, McGraw Hill, New York 1996
2. Instrument Engineers Handbook - Process Control and Optimization, Bela G. Liptak, Vol. 2, 4th Edition, CRC Press,2008
3. Introduction to Process Engineering and Design, Thakore and Bhatt, Tata McGraw-Hill, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI20) CYBER SECURITY FOR INDUSTRIAL AUTOMATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To understand the Industrial security environment and cyber attacks
- To analyze and assess risks in the industrial environment
- To access, design and implement cyber security
- To test and troubleshoot the industrial network security system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand Industrial security environment and cyberattacks
CO-2: Analyze and assess risks in the industrial environment
CO-3: Access the cybersecurity of IACS
CO-4: Design and implement cybersecurity and to test and troubleshoot the industrial network security system

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	3	-	3	2
CO-2	2	1	3	1	2	3
CO-3	-	1	2	-	2	2
CO-4	2	2	3	-	2	3

UNIT-I:
Introduction: Industrial security environment-Industrial automation and control system(IACS) culture Vs IT Paradigms- Cyberattacks: Threat sources and steps to successful cyber-attacks.

UNIT-II:
Risk Analysis Risk Identification, Classification and Assessment, Addressing Risk: Cyber security Management System (CSMS), organizational security, physical and environmental security, network segmentation, access control, risk management and implementation.

UNIT-III:
Accessing the Cybersecurity of IACS: Identifying the scope of the IACS- generation of cyber security information-identification of vulnerabilities- risk assessment-evaluation of realistic threat scenarios- Gap assessment- capturing Ethernet traffic-documentation of assessment results.

UNIT-IV:

Cybersecurity Design and Implementation: Cyber security lifecycle- conceptual design process- detailed design process- firewall design- remote access design- intrusion detection design.

Testing and Maintenance: Developing test plans- cyber security factory acceptance testing- site acceptance testing- network and application diagnostics and troubleshooting- cyber security audit procedure- IACS incident response.

UNIT-V:

Industrial Automation Security: Emerging Approaches to Industrial Automation Security- Internet of Things, Open platform communications unified architecture, Security and privacy, Big data analytics and the industrial Internet of Things, The National Institute of Standards Technology (NIST) Cyber-Physical Systems (CPS) Framework, Critical Infrastructure security, Software defined elements

TEXT BOOKS:

1. Industrial Automation and Control System Security Principles, Ronald and rutz, ISA, 2016

REFERENCES:

1. Cyber-security of SCADA and Other Industrial Control Systems, Edward J. M. Colbert and Alexander Kott, Springer, 2016
2. Network Security, David J. Teumim, 2nd Edition, ISA, 2010
3. Industrial Ethernet, Perry S. Marshall and John S. Rinaldi, 2nd Edition, ISA, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI21) BIO MEDICAL SIGNAL PROCESSING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To interpret the essential bio signals such as ECG and EEG
- To apply signal and data processing techniques to bio signals and applications in
- Biomedicine
- To illustrate the use of filters in motion artifacts removal
- To grasp the advancements of biomedical engineering with the help of modelling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Reflect on biological systems from a signals and systems viewpoint and apply suitable signal processing techniques
CO-2: Apply advanced data compressing, modelling, and signal processing techniques to ECG and EEG signals
CO-3: Design and implement digital filters for noise reduction in electrophysiological data
CO-4: Demonstrate real-world applications of Biomedical System Modelling

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	3	2	2	2
CO-2	-	-	3	2	2	3
CO-3	-	1	2	-	2	1
CO-4	1	1	2	2	2	2

UNIT–I:
Preliminaries: Biomedical Signal Origin, Dynamics, cardiovascular system and electrocardiogram, ECG Lead Configuration, ECG Applications, EEG lead Position, EEG Applications, Electromyography EMG, EMG Recorder, EMG Applications.

UNIT–II:
Removal of Artifacts: Removal of artifacts, statistical preliminaries, Time Domain Filtering: synchronized averaging, moving averaging filter, Derivative-based approach, Frequency Domain Filtering: Notch filters, Comb filters Optimal Filtering: Wiener filter, Adaptive Filtering, Selecting appropriate filter.

UNIT–III:
Event Detection: Event Detection, QRS detection methods-Differentiation based, Template based, Rhythm analysis and Arrhythmia detection algorithms. EEG rhythms,

waves, and transients, EEG Recording, EEG rhythms detection, homomorphic processing.

UNIT–IV:

Waveform Analysis: Case studies, morphological analysis of ECG wave, minimum phase correspondent and signal length, ECG Waveform analysis, Envelop extraction and analysis, Analysis of activity. Dicrotic Notch Detection, Frequency Analysis, Periodogram.

UNIT–V:

Modelling of Biomedical Systems: Motor unit firing pattern, cardiac rhythm, formants, and pitch of speech, point process, parametric system modelling, Auto-aggressive or All pole model, computation of model parameters, levinson-Durbin algorithm, ARMA Model.

TEXT BOOKS:

1. Biomedical Signal Analysis: A Case-Study Approach, Rangaraj M. Rangayyan, John Wiley & Sons, 2005
2. Biomedical Signal Processing, D. C. Reddy, The McGraw-Hill Companies, 2005

REFERENCES:

1. Biomedical Digital Signal Processing, Willis J. Tompkins, Prentice-Hall of India Pvt. Ltd., 2012
2. Statistical Digital Signal Processing and Modeling, Monson H. Hayes, Wiley-India, 2009
3. Biomedical Signal Processing, Prof. Sudipta Mukhopadhyay

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI22) NONLINEAR ADAPTIVE CONTROL

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To inculcate conceptual understanding of adaptive control
- To provide knowledge on various adaptive schemes, with a basic understanding on closed loop system stability and implementation issues
- To develop ability to design suitable stable adaptive scheme to meet the performance objectives even in the presence of disturbances and changing operating conditions
- To identify the need and apply appropriate adaptive control design technique to real time systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Formulate adaptive control design problem

CO-2: Identify suitable adaptive controller for a given system with uncertain parameters

CO-3: Apply adaptive design techniques to real time systems whose parameters change during operation

CO-4: Implement adaptive control schemes to meet the performance objectives in challenging situations

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	2	2	2
CO-2	3	2	2	2	2	2
CO-3	3	2	2	2	3	2
CO-4	3	2	3	2	3	2

UNIT-I:

Introduction to Adaptive Control, Common Myths in Control; Vector, Matrix and Signal Norms- Barbalat's Lemma and Illustration of use; Equilibrium definitions, Estimating Parameters in Dynamical Systems. Applications to Adaptive Control, Case Study.

UNIT-II:

Lyapunov Stability Definitions: stability, uniformity, attractivity, asymptotic stability, exponential stability; Stability of Linear systems, Function classes; Definiteness, radial boundedness, decrescence; Lyapunov stability theorems, La Salle's Invariance; Persistence of Excitation; Uniform Complete Observability; Alternate Exponential stability theorems.

UNIT-III:

Certainty Equivalence Adaptive Control: First and Second order systems; Detectability obstacle and Ortega construction. Backstepping in Adaptive Control; Backstepping for unmatched unknown, Unknown Control Gain adaptation; Model Reference Adaptive Control (MRAC)

UNIT-IV:

MARS Vs STR: Relations between MARS and STR - Integrator backstepping adaptation general case; Extended Matching – integrator backstepping adaptation, Tuning Functions based integrator backstepping adaptation, Robustness in adaptive control – sigma modification; Parameter projection

UNIT-V:

Introduction and applications, Radial Basis function based Neural Network function approximation, Multilayer Neural Networks, Deep Learning, Initial excitation adaptive control – single and double integrator

TEXT BOOKS:

1. Adaptive Control, Karl Johan Astrom and Bjom Wittenmark, Addison Wesley, 2003
2. Adaptive Control: Stability, Convergence and Robustness, S. Sastry and M. Bodson, Prentice Hall, 1989

REFERENCES:

1. Stable Adaptive Systems, K. S. Narendra and A. M. Annaswamy, Dover Publications, 2005
2. Nonlinear Systems, H. K. Khalil, 3rd Edition, Pearson Publications, 2002

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI23) INSTRUMENTATION AND CONTROL FOR PETROCHEMICAL INDUSTRIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To expose to various petroleum production processes
- To impart knowledge on various processes involved in petroleum refinery
- To provide knowledge on specific measurement techniques practiced, control systems and automation involved in petrochemical industry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform investigations to extract crude oil sources by using various instruments
CO-2: Implement safety and automation systems for smooth running of complex units in petrochemical plants
CO-3: Operate and maintain petrochemical processing equipment for refining of crude oil using distillation, reflux and reboiler systems
CO-4: Commission and test instrumentation equipment for oil refineries at different stages

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	2	1
CO-2	2	2	2	1	3	1
CO-3	2	2	2	2	3	2
CO-4	2	3	2	2	2	1

UNIT–I:
Introduction to Petroleum Products: Brief survey of petroleum formation, petroleum exploration, Petroleum production, Petroleum refining and its methods, refining capacity and consumption in India, constituents of Crude Oil, Recovery techniques – Oil – Gas separation, Processing wet gases.

UNIT–II:
P & I Diagrams for Petroleum Plants: P & I diagram of petroleum refinery, Atmospheric distillation process, Vacuum distillation process, Thermal cracking, Catalytic cracking, Catalytic reforming, and Utility plants – Air, N2, and cooling water.

UNIT–III:
Instruments for Petroleum Industries: Basics of field instruments, Parameters to be measured in Petrochemical industry, Distillation Column control, Selection of instruments, Basics of intrinsic safety of instruments, Area classification.

UNIT–IV:

Petroleum and its Chemicals: Chemicals from petroleum, Chemicals from methane, acetylene, ethylene and propylene - production routes of important petrochemicals such as polyethylene, polypropylene, ethylene dioxide, methanol, xylene, benzene, toluene, styrene, VCM and PVC.

UNIT–V:

Control of Petroleum Industries and its units: Control of furnace, Reboiler Control, Reflux Control, Control of catalytic crackers, Control of heat exchanger, Control of cooling tower.

Safety Systems for Petroleum Industries: Basics of PLC, and Safety interlocks in furnace, separator, pump, and compressor. Basics of SIL, Introduction to Standards.

TEXT BOOKS:

1. Chemical from Petroleum, Waddams A. L., Butter and Janner Ltd., 1968
2. Process Control Structures and Applications, Balchan J. G. and Mumme K. I., Van Nostrand Reinhold Company, New York, 1988
3. Chemical Process Industries, Austin G. T. Shreves, McGraw Hill International Student Edition, Singapore, 1985

REFERENCES:

1. Instrumentation in Process Industries, Béla G. Lipták, Chilton Book Company, 2005
2. Oil and Gas Production Handbook-An Introduction to Oil and Gas Production, Havard Devold, ABB ATPA Oil and Gas, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

UNIT-I:

Business Analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data Business Analytics Technology.

UNIT-III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V:

Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business Analytics-Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / Legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, New Delhi, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publisher's, Trivandrum
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, New Delhi, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw-Hill Education (India) Private Limited, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut, New Delhi
2. Engineering Optimization, S. S. Rao, New Age International Publications, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, Delhi, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, Delhi, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice-Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill Edition

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

REFERENCES:

1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing Co. Pvt. Ltd., 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996