H.K.E.SOCIETY'S

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, GULBARGA

Electronics and Instrumentation Engineering Branch

(Applicable for 2019-20 admitted batch)

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER

Code No.	Course	Hours / Week					Maximum Marks		
		Lecture	Tutorial	Self Study	Practical	Credits	CIE	SEE	Total
SEMESTER VI									
THEORY									
19HU61	Entrepreneurship Management and Finance	03	00		00	03	50	50	100
19EI62	Industrial Process Control	03	00	01	00	04	50	50	100
19EI63X	Elective-1	03	00		00	03	50	50	100
19EI64X	Elective-2	03	00		00	03	50	50	100
19EIIE65X	Industrial Elective	03	00		00	03	50	50	100
19EI6OEX	Open Elective-1	03	00		00	03	50	50	100
19HU02	Recruitment Process Training-II	00	02		00	01	50	50	100
PRACTICAL									
19EIL61	Virtual Instrumentation Lab	00	00		02	01	50	50	100
19EIL62	Process Measurement & Process Control Lab	00	00		02	01	50	50	100
19EIMP63	Mini Project	00	00		03	02	50	50	100
	Internship	To be carried out during the intervening vacations of VI and VII semester.							
					TOTAL	**24**	**500**	**500**	**1000**

CIE - Continuous Internal Evaluation, SEE – Semester End Examination

ELECTIVE - 1

1	19EI631	Industrial Data Communication & Networks
2	19EI632	Java Programming
3	19EI633	Switching Power Conversion

ELECTIVE -2

1	19EI641	Medical Imaging Systems
2	19EI642	Robotics & Automation
3	19EI643	Fuzzy Logic & Neural Networks

INDUSTRIAL ELECTIVE

1	19EIIE65	Design and Detail Engineering on Instrumentation and Control
2	19EIIE652	Essentials of Information Technology

OPEN ELECTIVE-1

1	19EI6OE1	Transducers and Process Instrumentation

Course Title: Entrepreneurship Management and Finance		
Course Code	19HU61	CIE: 50
Number of Lecture Hours/Week	03 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours :42	Credits: 03	SEE Hours:03
Prerequisite:		

Course Objectives: To enable the students to obtain the basic knowledge about Entrepreneurship and
Management and finance in the following topics:-

1. The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship,. Government Support for Entrepreneurship
2. Management – Meaning, nature, characteristics, scope , functions, role etc and Engineers social responsibility and ethics
3. Preparation of Project and Source of Finance
4. Fundamentals of Financial Accounting
5. Personnel and Material Management, Inventory Control

Modules	Teaching Hours
Module I **Entrepreneur** : Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Entrepreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD.	**08 Hrs**
Module II **Management**: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Roles of Management, Levels of Management, Henry Fayol - 14 Principles to Management , Engineers Social responsibility and Ethics.	**08 Hrs**
Module III **Preparation Of Project And Source Of Finance**: Preparation of project: Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; SOURCE OF FINANCE: Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc).	**08 Hrs**
Module IV **Fundamentals Of Financial Accounting:** Definition, Scope and Functions of Accounting , Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet.	**09 Hrs**

Module V **Personnel Management, Material Management And Inventory Control**: **Personnel management**: Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives. **Material Management And Inventory Control**: Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level (Re-order level, Minimum level, Maximum level, Average level and Danger level.)	**09 Hrs**
Question paper pattern: 1. Solve five full questions selecting at least one question from each Module	

Text books:

1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N & Maheswari S
K -Vikas Publishing House.

2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications ,Prof Manjunatha & Amit kumar
G – laxmi Publication, Veerbhadrappa Havina l-New Age International Publications.

3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi

Reference Books:

1. Industrial Organization & Engineering Economics-T R Banga & S C Sharma- Khanna Publishers, Dehli.

E books and online course materials:

www.wipo.int
www.ipindia.nic.in

Pre requisites : None

Course Outcomes : At the end of the course the students are able to

Course Code	CO #	
19HU61	**CO1**	Develop entrepreneurship skills
	CO2	Apply the concepts of management and engineers social responsibility and ethics practice
	CO3	Prepare project report and choose different source of finance
	CO4	Apply fundamentals of financial accounting and interpret the final accounts
	CO5	Apply personal management skills, materials and inventory control techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2	2	3	3	2	3	3	2		
CO2	2	1				1	2	3	3	3	3	2	3		
CO3	2					1	1	2	3	3	3	2	3		
CO4	2					1	1	2	3	3	3	2	3		
CO5	2					1	1	2	2	2	2	3	2		

Course Title: Industrial Process Control		
Course Code	19EI62	CIE: 50
Number of Lecture Hours/Week	04 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 52	Credits: 04	SEE Hours:03

Prerequisite: Process Control

Course Objectives:

1. To understand the concept of heat exchangers and furnace controls
2. Provide the knowledge of controls for boilers and distillation column
3. Impart the knowledge of evaporators crystallizes find dryer controls
4. To import the knowledge of compressor controls and water treatment techniques
5. To provide the knowledge of wiring diagrams and panel board design

Modules	Teaching Hours
Module I **Heat exchanger and its control schemes:** Classification of heat exchangers as per fluid flow arrangement and construction. Feedback, feed-forward and bypass control schemes. **Furnace control**: Startup heaters, fired re-boilers, process and safety controls.	**10 Hrs**
Module II **Boiler control:** Types, working and operation of boilers, safety interlocks, terms related shrink and swell effect, boiler efficiency. Drum level and feed water control schemes- single, two and three elements and combustion control types 1, 2, 3 steam temperature control, boiler pressure control, furnace draft control, air-fuel ratio combustion control schemes. **Distillation column:** Basic principle, distillation equipment and its accessories. Batch and continuous distillation, binary product distillation, multi product distillation, side draw product distillation column. Distillation column control strategies- top and bottom product composition controls, column pressure control schemes.	**12 Hrs**
Module III **Dryer control:** Study of drying curve and drying rate curve, classification of dryers. Batch type dryer control schemes: Atmospheric tray dryers, fluid bed dryer, vacuum dryers. Continuous type dryer control schemes: Double drum dryer, continuous Fluid bed dryer, rotary dryers, turbo dryer and spray dryer. **Evaporator control:** Evaporator terminologies, types of evaporator, mathematical model for evaporator, control systems for evaporator- feedback, cascade, feed forward and selective control. **Crystallizes:** Process of crystallization, super-saturation methods, and types of crystallizes. Cooling crystallizers, vacuum crystallizes and reaction crystallizes.	**10 Hrs**
Module IV (Self Study) **Compressor controls:** Classification, phenomena of Surge for Centrifugal compressors, method of surge control for compressor. **Water treatment controls:** The control of water treatment. Chemical oxidation,	**10 Hrs**

Chemical reduction, Neutralization and Precipitation.	
Module V **Preparation of wiring diagrams for instrument applications:** Objective of schematic wiring diagrams, preparation of schematic diagrams, designation and symbols commonly used in schematic wiring diagrams. **Instrument panel board design and construction:** Panel board functions and types, panel board design: Basic arrangements of instrumentation, panel dimensions, panel materials, location of panels. Control room design: Piping and wiring, panel board piping, panel board wiring, basic panel board construction, panel board layout	**10 Hrs**

Textbooks:

1. Instrument Engineers Handbook Process Control-Bela G. Liptak-Chilton book company, third edition, 1995.
2. Handbook of Applied Instrumentation-Douglas M Considine S.D Ross, McGraw Hill book company 1964.

Reference book:

1. Instrument Engineers Handbook Process Control-Bela G. Liptak, Chilton book company, First edition, 1973.
2. Unit operation and Chemical Engineering-W.L. McCabe and Julian Smith, Tata McGraw Hill 6th edition 2001.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI62	**CO1**	Explain heat exchange and furnace control concepts
	CO2	Demonstrate the knowledge of boilers and distillation column controls
	CO3	Describe dryers and you operator control concepts
	CO4	Explain the compressor control and water treatment control
	CO5	Demonstrate the knowledge of wiring diagram and instrument panel board design

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1									1	3	1	
CO2	3		1									1	3	1	
CO3	3		1									1	3	1	
CO4	3		1			2	2					1	3	1	
CO5	3		1									1	3	1	

Course Title: Industrial Data Communication and Networks		
Course Code	19EI631	CIE: 50
Number of Lecture Hours/Week	03 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours: 03
Prerequisite: Basics of Communication Systems		

Course Objectives:

To make students understand the

1. OSI reference model, LAN network, different Open control network.
2. Networks at different levels such as sensor level, device network control.
3. HART, Foundation field bus.
4. Wireless technologies.

Modules	Teaching Hours
Module I **Introduction:** OSI reference model, LAN architecture and topology Transmission media: UTP cable, STP cable, co-axial cable, fiber optics, wireless media Data Link Layer, MAC sublayer (media access algorithums), error detection and correction code Network components: repeaters, bridge, hub, switch, router, gateways.	**08 Hrs**
Module II **Open control network:** RS232, RS422, EIA 485, Ethernet- MODBUS – structure, function codes and implementation, General Purpose Instrument Bus, specifications. **Proprietary control network:** MODBUS plus, data highway plus.	**08 Hrs**
Module III **Networks at different levels:** Sensor level network: AS-i, CAN, Devicenet, Interbus and LON. **Device network:** Foundation Fieldbus –H1, HART, PROFIBUS-PA Control network: BACnet, ControlNet, FF-HSE, PROFIBUS-DP, Ethernet, TCP/IP. Network Topologies and IEEE standards[IEEE 802.3, 802.4, 802.5].	**08 Hrs**
Module IV **Foundation fieldbus:** Fieldbus requirement, features, advantages, fieldbus components, types, architecture–physical, data link, application layer, system and network management, wiring, segment functionality checking, installation in safe and hazardous area and troubleshooting, function block application process. OPC Architecture.	**10 Hrs**
Module V **HART:** Architecture – physical, data link, application layer, communication technique, normal and burst mode of communication, troubleshooting, benefits of HART. **Wireless technologies:** Satellite systems, Wireless LANs (WLANs), WiFi, VPAN, Zigbee, bluetooth GPRS and – their comparison, limitations and characteristics.	**08 Hrs**

Question paper pattern:
Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:

1. Practical Industrial Data Communications-Deon Reynders, Steve Mackay, Edwin Wright, 1st edition ELSEVIER, 2005.
2. Industrial data communication-Lawrence M Thompson, 2nd edition, 1997.

Reference Books:

1. Real time Control Network-Deniel T Miklovic, ISA 1993.
2. Process software and digital networks -Bela G Liptak, 3rd edition, 2002.
3. Computer networks -Andrew S. Tanenbaum, 4th edition, PHI/Pearson Education, 2002.
4. Data Communications and Networking -Behrouz A. Forouzan, 2nd update edition, Tata McGraw Hill Publishing Company, New Delhi,2000.
5. Computer Networks and Internets -Douglas E. Comer, 2nd Edition, Pearson Education Asia, 5th Indian reprint, 2001.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI631	**CO1**	Explain the concept of reference model, transmission media and network components.
	CO2	Analyze different levels Medias for data control transmission between devices.
	CO3	Illustrate the concept of network at different levels such as sensor level and device network control.
	CO4	Demonstrate the network management, wiring segment functionality checking and OPC architecture.
	CO5	Demonstrate HART architecture and various wireless technologies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2										2	3		
CO2	2	2	2	1								2	3		
CO3	2	2	3	1	2							2	3		
CO4	1	2	1	2	2							2	3		
CO5	2	1	1	2	3							2	3		

Course Title: Java Programming		
Course Code	19EI632	CIE: 50
Number of Lecture Hours/Week	3 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours :42	Credits: 03	SEE Hours:03
Prerequisite: Programming Concepts.		

Course Objectives:

1. Learn fundamental features of object oriented language and JAVA
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts.

Modules	Teaching Hours
Module I **An Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings.	. **08 Hrs**
Module II **Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.	**08 Hrs**
Module III **Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A **Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.	**10 Hrs**
Module IV **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.	**08 Hrs**

Module V	
Enumerations, Type Wrappers: I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instance of, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using value Of ( ), Changing the Case of Characters Within a String , Additional String Methods, String Buffer, String Builder.	**08 Hrs**

Question Paper Pattern:

Total 10 questions will be asked. Two from each module. The student has to answer five questions selecting at least one from each module.

Text books:

1. Java The Complete Reference -Herbert Schildt, 7th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. Programming with Java -Mahesh Bhave and Sunil Patekar, First Edition, Pearson Education,2008, ISBN:9788131720806.
2. Object Oriented Programming with Java -Rajkumar Buyya,S Thamarasi Selvi, Xingchen Chu, Tata McGraw Hill education private limited.
3. Programming with Java A primer -E Balagurusamy, Tata McGraw Hill companies.
4. JAVA One step Ahead -Anita Seth and B L Juneja, Oxford University Press, 2017.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI632	**CO1**	Explain the object-oriented concepts and JAVA.
	CO2	Demonstrate the knowledge of various operators.
	CO3	Discuss about the classes, packages and interfaces.
	CO4	Develop computer programs to solve real world problems in Java.
	CO5	Develop simple GUI interfaces for a computer program to interact with users.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2							3	1	3	
CO2	3	2	2		1							2	1	3	
CO3	3	2	2		1							3	1	3	
CO4	3	2	2		1							3	1	3	
CO5	3	2	2		1							3	1	3	

Course Title: Switching Power Conversion		
Course Code	19EI633	CIE: 50
Number of Lecture Hours/Week	3hrs. (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours: 03

Prerequisite: Power Electronics and Electronic Circuits.
This course is intended as the advanced course on power electronics.

Course Objectives:

1.To study and analyze various types of switched mode dc- dc converters and its switching techniques.

2. Ability to analyze and design switched mode power converters

3. Proper understanding about soft switching and its applications Control, Drive and Protection of Power Switching Devices

Modules	Teaching Hours
Module I **DC-TO-DC Converter:** Introduction, Simple DC to DC Converter, Series Controlled Regulator, Shunt Controlled Converter, Practical Regulators, Switched Mode Power Converters, Primitive dc-to-dc Converter, A Simplified Analysis Of The Primitive Converter, Non idealities in the Primitive Converters: More Versatile Power Converters, Buck Converter, Boost Converter, Buck-Boost Converter, Discontinuous Mode of Operation in dc to dc Converters, Buck converter in DCM Operation, Isolated dc to dc Converters, Forward Converter, Push-Pull converter, Half and Full Bridge Converter, Fly-back Converter, Problem Set	**09 Hrs**
Module II **DC-TO-DC Converter Dynamics:** Introduction, Pulse Width Modulated Converter, Dynamic and Output Equations of the Converter, An Idealized Example, A More Realistic Example, Averaged Model of the Converter, Steady State Solution, Small Signal Model of The Converter, Transfer Functions of the converter, Example of a Boost Converter, Circuit Averaged Model of the Converters, Generalised State Space Model of the Converter, Generalised Model, Linear Small signal Model, Dynamic functions of the Converter, Circuit Averaged Model Quantities, Some Examples, Buck Converter, Boost Converter, Buck-Boost Converter, Dynamic Model of Converters Operating in DCM, Dynamic Model, Fly back Converter Example, Problem Set	**08 Hrs**
Module III **Closed Loop Control of Power Converters:** Introduction, Closed Loop Control, Control Requirements, Compensator Structure, Design of Compensator, A Simple Design Example, Closed Loop Performance Functions, Audio Susceptibility, Input Admittance, Output Impedance, Effect of Input Filter on the Converter Performance, Design Criteria For Selection of Input Filter, Design Example, Problem Set **Current Programmed Control of DC to DC Converters:** Introduction, Sub-harmonic Instability in Current Programmed Control, Compensation to Overcome Sub-harmonic Instability, Determination of Duty Ratio for Current Programmed Control, Buck Converter, Boost Converter , Buck-Boost Converter, Transfer Functions, Buck Converter, Boost Converter, Buck-Boost Converter, Problem Set.	**10 Hrs**
Module IV **Soft Switching Converters:** Introduction, Resonant Load Converters, Principle of	

Operation, SMPS Using Resonant Circuit, Steady State Modeling of Resonant SMPS, Approximate Design Procedure, Design Example, Resonant Switch Converters, Switch Realisation, Buck Converter with Zero Current Switching, Operation of the Circuit, Conversion Ratio of the Converter, Half-wave Operation of the Converter, Boost Converter with Zero Voltage Switching, Resonant Transition Phase Modulated Converters, Basic Principle of Operation, Analysis of a complete cycle of operation, Design considerations to achieve ZVS, Development Examples, Resonant Switching Converters with Active Clamp, Analysis of Active Clamp ZVS Buck Converter, Steady State Conversion Ratio, Equivalent Circuit, Problem Set	**08 Hrs**
Module V **Unity Power Factor Rectifiers:** Power Circuit of UPF Rectifiers, Universal Input, Average Current Mode Control, Voltage Feed forward Controller, Resistor Emulator UPF Rectifiers, Non-linear Carrier Control, Scalar Controlled Resistor Emulator, Single Phase and Polyphase Rectifier, Problem Set	**07 Hrs**

Question paper pattern: Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books/Reference Books:

1. Fundamentals of Power Electronics -Robert Ericson, Chapman & Hall, 2004.
2. Switched Mode Power Conversion- V. Ramanarayanan, 2007.
3. Power Electrionics: Essentials and Applications -Umanand.L,Wiley India, 2009.
4. Power Semiconductor Devices -B. Jayant Baliga, PWS 1996.

E books and online course materials:

1. Course on Switched Mode Power Conversion is available at:http://nptel.ac.in/courses/108108036/Prof. V.Ramanarayanan and Prof. L.Umanand's
2. Book on Power Electronics is available at: http://www.ee.iisc.ac.in/new/people/faculty/vjohn/ref/smpcbook,%20VR.pdf Prof. V.Ramanarayanan

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO	Course Outcome (CO)
19EI633	CO1	Distinguish auxiliary circuits associated with power electronics and DC-DC Converters
	CO2	Design and Develop DC-DC converters
	CO3	Control of DC-DC Converters
	CO4	Appraise of soft switching converters over other converters.
	CO5	Distinguish of Rectifiers as per the requirement

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2							2	3	1	
CO2	3	3	1		1							2	3	1	
CO3	3	2	2		1							2	3	1	
CO4	3	3	2		2							2	3	1	
CO5	3	2	2		1							2	3	1	

Course Title: Medical Imaging Systems		
Course Code	19EI641	CIE: 50
Number of Lecture Hours/Week	03 Hrs.(Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours:03
Prerequisite: Engineering Physics.		

Course Objectives:

The students are made to understand:

1. About the different Imaging equipments.
2. About the different imaging modalities and compare their results.
3. About the biological effects of x-ray, MRI and Ultrasound on the human body.
4. About the Nuclear and Thermographic equipments.

Modules	Teaching Hours
Module I **X-ray Machines and Digital Radiography:** Basics of diagnostic radiology, Nature of X-rays, Production of X-rays, X-ray Machine, Visualization of X-rays, Physical Parameters for X-ray Detectors, Biological effects of ionizing radiation.	**08 Hrs**
Module II **X-ray Computed Tomography:** Computed tomography, System components, Gantry Geometry, Discussion on reconstruction algorithms, Patient dose in CT Scanners.	**08 Hrs**
Module III **Ultrasonic imaging systems:** Diagnostic ultrasound, Basic pulse echo apparatus, A-mode, M-mode and B-mode Principles of echocardiography. Real time ultrasonic imaging systems, Biological effects of ultrasound.	**08 Hrs**
Module IV **Magnetic resonance imaging systems:** Principles of NMR Imaging systems, Image reconstruction techniques, Basic NMR Components, Biological effects of NMR Imaging, Advantages of NMR Imaging Systems. **Nuclear medical imaging systems:** Radio-isotopes in medical diagnosis, Radiation detectors, Radio isotope rectilinear scanner, The gamma cameras,Single photon emission computed tomography, position emission tomography**.**	**10 Hrs**
Module V **Thermal imaging systems:** Medical thermography, Physics of thermography, Infrared detectors, Thermographic equipment, Quantitative medical thermography.	**08 Hrs**

Question paper pattern:

Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:

1. Hand Book of Biomedical Instrumentation - R.S.Khandpur.

Reference Books:

1. Principles of medical imaging, Academic press - Kirk Shung.

Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19EI641	**CO1**	Explain the principles x-ray machine and digital radiography.
	CO2	Describe the concept of computed tomography.
	CO3	Demonstrate the knowledge of ultrasonic imaging system.
	CO4	Demonstrate the knowledge of ultrasonic imaging system.
	CO5	Demonstrate the concept thermal imaging system.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3										3	1	
CO2	2												2	1	
CO3	3	1											3	1	
CO4	3	2											3	2	
CO5	2	1	1										2	1	

Course Title: Robotics and Automation		
Course Code	19EI642	CIE: 50
Number of Lecture Hours/Week	03 Hrs.(Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours: 03
Prerequisite: Control System		

Course Objectives: The students are made to understand.

1. The robotic applications.
2. Sensors used in robotics.
3. Interfacing of robot for vision sensing image analysis.
4. Assembly of robotics.

Modules	Teaching Hours
Module I **Fundamentals of Robotics & SCADA:** Automation and robotics, robots in science fiction, history of robotics, robotics market and future prospects, robot anatomy, work volume, robot drive systems, control systems and dynamic performance, precision of movement and robot applications.[Textbook-1] SCADA: Introduction and brief history of SCADA, SCADA systems software, considerations and benefits of SCADA system. [Textbook-2]	**08 Hrs**
Module II **Control Systems and Components: Basic control systems concepts and models, controllers, robot actuation and feedback components. Robot end effectors: T**ypes of end effecters, mechanical grippers, other types of grippers, tools as end effectors, robot/end effectors interface, consideration in gripper selection and design, problems. **Sensors in Robotics**: Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors [Textbook-1]	**08 Hrs**
Module III **Machine Vision & Artificial Intelligence:** Introduction to machine vision, The sensing and digitizing function in machine vision, image processing and analysis: image data reduction, segmentation, feature extraction, object recognition, training the vision system, robotic applications. **Artificial Intelligence (AI):** Goals of AI in research, AI techniques: knowledge representation, problem representation and problem solving and search techniques in problem solving. [Textbook-1]	**08 Hrs**
Module IV **Robot cell design and control, Material Transfer, Machine Loading/Unloading:** Robot cell layouts, multiple robots and machine interference, other considerations in work -cell design, work-cell control, interlocks, error detection and recovery, work -cell controller, robot cycle time analysis. **Material Transfer, Machine Loading/Unloading:** General considerations in robot material handling, material transfer applications, machine loading and unloading. [Textbook-1]	**10 Hrs**

Module V	
Processing Operations, Assembly & Inspection: Spot welding, continuous arc welding, spray coating, other processing operations using robots. Assembly and robotic assembly automation, parts presentation methods, assembly operations, compliance and remote center compliance (RCC) device, assembly system configurations, designing for robotic assembly, inspection automation. [Textbook-1] **Autonomous Mobile Robots: Introduction, Planning &Navigation:** Introduction, basic control scheme for mobile robots (only basic understanding of perception, localization, path planning & motion control). [Textbook-3]	**08 Hrs**

Question paper pattern:

Total 10 questions will be asked. Two from each module. The student has to answer five questions selecting at least one from each module.

Text books:

1. Industrial Robotics: Technology, Programming and Applications - Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and AshishDutta, 2nd Edition, Tata McGraw Hill, 2012.
2. Industrial Automation: For Engineers and Technicians - Srinivas Medida, Pocket Guide on 1st Edition, IDC Technologies, 2007. (http://www.pacontrol.com/download/Industri al-Automation-Pocket-Guide.pdf)
3. Introduction to Autonomous Mobile Robots - Roland Siegwart, Illah R. Nourbakhsh, and DavideScaramuzza, 2ndEdition, PHI, 2011.

Reference Books:

1. Control in Robotics and Automation: Sensor Based Integration - Ghosh, Allied Publishers, Chennai, 1998.
2. Robots and manufacturing Automation - Asfahl C.R., John Wiley, USA 1992.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI642	**CO1**	Identify basic components of robot system and its functionality
	CO2	Identify DH representation of robot and homogenous transformation for various arm configurations.
	CO3	Analyze the functions of sensors in the robot.
	CO4	Solve forward and inverse kinematic problems. Evaluate and compare the use Robots in different applications.
	CO5	Recognize material-handling applications, processing operations, assembly and inspection operations to increase product quality and uniformity in minimize cycle times and effort

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3									2	3	2	
CO2	3	2	2	2								3	3	2	
CO3	3	2	3	2								3	3	1	
CO4	3	3	2	2								3	3	1	
CO5	3	3	3	2								3	3	1	

Course Title: Fuzzy Logic and Neural Network		
Course Code	19EI643	CIE: 50
Number of Lecture Hours/Week	03 Hrs.(Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours:03
Prerequisite: Logic Design		

Course Objectives

The students are made to understand:

1. Basic concepts of neural networks.
2. Different learning processes and single layer perception
3. Basic concepts of fuzzy logic.
4. Fuzzy relation and membership functions.

Modules	Teaching Hours
Module I **INTRODUCTION TO NEURAL NETWORKS:** What is neural network? Human brain, models of a neuron, neural networks viewed as directed graphs, feedback, network architectures, knowledge representation, artificial intelligence and neural networks.	**08 Hrs**
Module II **LEARNING PROCESSES:** Introduction, error correction algorithm, memory based learning, Hebbian learning, competitive learning, Boltzmann learning with a teacher, learning tasks, memory adaptation.	**08 Hrs**
Module III **SINGLE LAYER PERCEPTIONS:** Introduction, prceptron and perception convergence theorem, Examples. Multilayer perceptron: Introduction, some preliminaries.	**08 Hrs**
Module IV **INTRODUCTION TO FUZZY LOGIC:** Uncertainty and imprecision, state and random processes, uncertainty in information, fuzzy sets and classical sets, properties, mapping of classical sets to function, fuzzy set operation, properties of fuzzy sets. **CLASSICAL RELATIONS AND FUZZY RELATIONS:** Cartesian product, crisp relations, fuzzy relations, tolerance and equivalence relations, fuzzy tolerance, value assignments	**10 Hrs**
Module V **MEMBERSHIP FUNCTIONS:** Features of membership functions, standard forms and boundaries, fuzzification, membership value assignment. Fuzzy to crisp conversions: lambda cuts for fuzzy sets, lambda cuts for fuzzy relations, defuzzification methods.	**08 Hrs**

Question paper pattern:

Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.

Text books:

1. Neural Networks a coprehensive foundation – Simon Haykin, McMillan College public company, NewYork 1994.
2. Artificial Neural Networks – B. Yegnanarayana, PHI, 1999.
3. Fuzzy Logic with Engineering Applications – Timothy J. Ross, MGH Internationa Edition, 1997.

Reference Books:

1. Introduction to Artificial Neural Systems – Jacek M. Zurada Jaico Publishing Company.
2. Neural Network Fundamentals with Graphs, Algorithms and Applications – N. K. Bose, P. Liang, TMH Edition, 1998.
3. Artifical Neural networks – Robert J Schalkoff, MGH International Edition, 1997.
4. Neural Networks and Fuzzy Systems, A Dynamical systems approach to machine intelligence – Bart Kosko, PHI Publications, 2006.
5. Fuzzy Logic, Intelligence, Control and Information – John Yen, Rena Langari, Pearson Education 2005.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EI643	**CO1**	Explain the basic concepts of neural networks
	CO2	Use various learning algorithms of neural networks.
	CO3	Use the concept of single layer perception for different applications.
	CO4	Demonstrate the knowledge of classical set, Fuzzy sets and Fuzzy relations.
	CO5	Apply fuzzy logic concepts for different applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										2	3		
CO2	3	2										2	3		
CO3	3	2										2	3		
CO4	3	2										2	3		
CO5	3	2										2	3		

Course Title: Design and Detail Engineering on Instrumentation and Control		
Course Code	19EIIE65	CIE: 50
Number of Lecture Hours/Week	3 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours:03
Prerequisite: Basic Instrumentations		

Course Objectives

1. To Understand the basic Instrumentation in oil and gas industries.
2. To understand the design and selection implemented in industries for pressure measurement
3. To understand the Instrumentation design concept for level and temperature measurement
4. To impart theory of industrial deliverables

Modules	Teaching Hours
Module I **General** : Introduction to Instrumentation & Control in Design & Detail Engineering for Oil & Gas, Petrochemical, Refinery & other process industries, Instrumentation in industries, EPC & its concepts, FEED & Basic Engineering, Instrumentation interface with other disciplines, Importance of Instrumentation design in process industries, PFDs and P&IDs ,Instrument Symbols, Tagging and Loop philosophies, Types of Signals	. 08 Hrs
Module II **Design and selection of Pressure Gauge & Transmitter** Pressure measurement: Purpose, Features and Design / Selection, Design of pressure gauge, Typical installation of pressure gauge, Design of pressure transmitters, Design of pressure switches and Block diagram for transmitter.	08 Hrs
Module III **Design and selection of Level Gauge & Transmitter** Level measurement : Purpose, Features and Design/Selection, Level Instrumentation Concepts : Measurement Types, Level Instrumentation Concepts, Level transmitter types, Datasheets, Design Aspects, Level measurement using DP transmitter in Open Tank and Level switch working philosophy **Design and selection of Temperature Gauge & Transmitter** Temperature measurement – Purpose, Features and Design/Selection, Temperature Measurement Concepts/Applications, Major Classifications of Temperature Measurement Elements, Electrical Temperature Measuring Elements – Thermocouple and RTD , Electrical Resistance – Temperature Curves: Comparison of Thermocouple & RTD, Temperature Transmitters and its assembly and Datasheets	09 Hrs
Module IV **Design and selection of Flow Meters:** Flow & Fluid Types, Requirements for Flow Measurement,Factor affecting Flow meter Performance, Selection of Flow Meters, Variable Head or Differential Meter, Merits and Demerits – Differential Flow Meter, Flowmeter Types and applications, Typical Installation of Orifice plate and Orifice Plate Datasheets.	09 Hrs

Design and selection of Control Valves: Control Valves and their Applications , Classification of Valves.Characteristics of Valve, Methods of controlling flow through a valve, Parts of valves, Types of valves, Valve Design and Selection Considerations, Valve Material Selections, Leakage Classes, Control Valve Actuators and Control Valve Datasheets	
Module V **Instrument Design Deliverables:** Detail Engineering - Instrumentation Deliverables, Input & Output (I/O) List, Instrument Datasheet, Instrument Hookup Drawing, Instrument Loop Diagram, Instrument Layout Diagram, Instrument Junction Box Schedule, Cable Schedule, Interconnection Diagram, Instrument Bill of Material,	08 Hrs

Question Paper Pattern: Total 10 questions will be asked. Two from each module. The student has to answer five questions selecting at least one from each module.

Text books:

1.Instrumentation and Control Systems Documentation, Second Edition Meier, Frederick A. Meier, Clifford A. Published by International Society of Automation (2011) ISBN 10: 1936007517 ISBN 13: 9781936007516

2. Fundamentals of Industrial Instrumentation and Process Control, Second Edition Dunn, William, Published by McGraw Hill (2018),ISBN 10: 1260122255 ISBN 13: 9781260122251

Reference Books:

1. Piping and Instrumentation Diagram Development Moe Toghraei, Published by John Wiley & Sons (2019) ISBN 10: 1119329337 ISBN 13: 9781119329336

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EIIE65	**CO1**	Explain the general instrumentation used in oil and gas industry
	CO2	Implement the selection procedures for Pressure gauges
	CO3	Apply the basic design concept for level and temperature measuring devices
	CO4	Implement the basic design flow and control valves procedures for Pressure gauges
	CO5	Generate the deliverables data's of instrumentation systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1								2	2		
CO2	3	3	3	2								2	2		
CO3	2	3	3	2								2	3		
CO4	2	3	3	2								2	2		1
CO5	3	3	3	1							2	2	1		1

Course Title: Transducers and Process Instrumentation		
Course Code	19EI6OE1	CIE: 50
Number of Lecture Hours/Week	03 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 42	Credits: 03	SEE Hours: 03
Prerequisite: Basic Electrical Engineering.		

Course Objectives

1. To impart the basic measuring technique.
2. To understand the dynamic behavior of measuring instruments.
3. To impart the knowledge of classification of measuring instruments.
4. To understand the process measuring principles using transducers.

Modules	Teaching Hours
Module I **General Measurements And Measurement Systems:** Introduction, significance of measurements, methods of measurement, primary, secondary and terrestrial measurements, Instruments and Measurement systems, Classification of instruments, Deflection and null type instruments, functions of instruments and Measurement systems, Application of measurement systems, information and signal processing, elements of generalized measurement system. **Static Characteristics Of Instruments And Measurement Systems:** Measurement system performance, static calibration, static characteristics, errors in measurements, true value, static error, static correction, scale range and scale span, error calibration curve, scale readability, reproducibility and repeatability, drift, noise, accuracy and precision, indication of precision, significant figures, range of doubt for possible errors and doubtful figures, discrepancy, static sensitivity, linearity, hysteresis, threshold, dead time, dead zone, resolution or discrimination, loading effects. **Errors in measurement:** Limiting errors, relative limiting errors, combination of quantities with limiting errors, known errors, types of errors, gross errors, systematic errors, random errors.	**08 Hrs**
Module II **Dynamic Characteristics Of Instruments:** Dynamic response, dynamic analysis of measurement systems, and mathematical models of measurement systems, linear and nonlinear systems, modeling of thermal systems, liquid level systems, pneumatic systems, transfer function, block diagram representation, impulse response of linear system, sinusoidal transfer function. **Primary Sensing Elements And Transducers:** Introduction, mechanical devices as primary detectors, mechanical spring devices, pressure sensitive primary devices, electrical transducer, classification of transducers, characteristics and choice of	**09 Hrs**

transducers, summary of factor influencing the choice of transducers.	
Module III **Resistive Transducers:** Potential meters: Loading effect, power rating of potential meters, linearity and sensitivity, construction of 300 meters, helipots, materials used for potential meters. **Inductive Transducers:** Variable inductive transducers: Transducers working on principle of self inductance, differential output of inductive transducers, transducers working on the principle of mutual inductance, types of inductive transducers, transducers working on the principle of Eddy Currents Linear variable differential Transformers (LVDT),Advantages, disadvantages and uses of LVDT. Rotary variable differential transformer (RVDT).	**09 Hrs**
Module IV **Capacitive Transducers:** Transducer using change in area of plates, transducer using change in distance between plates, differential agreement of capacitive transducers, variation of dielectric constant for measurement of displacement, variation of dielectric constant for measurement of liquid level, advantages of capacitive transducers, disadvantages of capacitive transducers, uses of capacitive transducers. **Piezoelectric Transducers:** Modes of operation of piezoelectric crystals, properties of piezoelectric crystals, uses of piezo electrical materials and transducers. **Halls effect transducer:** Application of hall effect transducer.	**08 Hrs**
Module V **Temperature Transducer:** Introduction, Classification of temperature measuring devices, electrical methods of measurement of temperature, electrical resistance thermometers, or resistance temperature detector, semi-conductor thermometers thermistors, thermocouples. **Strain Gauges:** Theory of strain gauges, types of strain gauges, unbounded metal strain gauge, bonded wire strain gauges, bonded metal foil strain, your operation deposited thin metal strain gauge, semiconductor strain gauges, diffused strain gauges, Rosettes.	**08 Hrs**
Question paper pattern: Total ten questions will be asked. Two from each module. The student has to answer five questions, selecting at least one from each module.	
Text Books: 1. Electrical Measurements and Instrumentation - A.K.Sawhney and Puneet Sawhney published Dhanpat Rai & Co. (P) Ltd., Delhi.	
Reference Books: 1. Instrument Transducer - K.P. NEUBERT. 2. Instrumentation Devices and Systems - Rangan, Mani & Sharma.	
Course Outcomes: **On completion of the course, the student will have the ability to:**	

Course Code	CO #	Course Outcome (CO)
19EI6OE	**CO1**	Describe the general measurement systems, errors and static characteristics of instrument transducers.
	CO2	Describe the dynamic characteristics of Instrument Transducers and primary sensing elements and develop the transfer function of hydraulic, thermal, pneumatic and electrical systems.
	CO3	Illustrate the construction and working of resistive and inductive transducers.
	CO4	Demonstrate the principle, working and construction of capacitive, piezoelectric and halls transducers.
	CO5	Explain the principle of working and construction of temperature measuring instruments and strain gauges.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											3	3	
CO2	3	2										2	3	3	
CO3	3	3	2									2	3	3	
CO4	3	3	3									2	3	3	
CO5	3	3	2									2	3	3	

Course Title: Recruitment Process Training-II		
Course Code	19HU02	CIE: 50
Number of Lecture Hours/Week	02 Hrs (Theory)	SEE: 50
Total Number of Lecture Hours : 28	Credits: 0:2:0:1	SEE Hours: 03
Topics		
Quantitative aptitude		**Teaching Hours**
Time and Work Time Speed and Distance Permutation and Combination Probability Data Interpretation Allegation and Mixture		12 Hrs
Verbal aptitude		
Sentence Completion Sentence Correction Change of Speech Change of Voice		06 Hrs
Reasoning Aptitude		
Coding and Decoding Syllogisms Data Sufficiency Clocks Calendars		06 Hrs
Soft skills		
Group Discussions – Do's and Don'ts Types of Interviews Preparing a good resume Email Writing		04 Hrs

Course Title: Virtual Instrumentation Lab		
Course Code	19EIL61	CIE: 50
Number of Practical Hours/Week	02 Hrs (Practical)	SEE: 50
	Credits: 01	SEE Hours: 03

Prerequisite: Biomedical Instrumentation (15EI52)

Course Objectives

1. To understand the concepts of VI and implement it for arithmetic operations.
2. To create VI for implementing filters.
3. To create VI for implementing combinational circuits.
4. To know the implementation of given expressions.
5. To understand the concepts of interfacing using VI.

List of Experiments

Experiments on LabVIEW software:

1. Implementation of adders and subtractors.
2. Implementation of 4:1 MUX. and 2 to 4 decoder.
3. Implementation of binary to grey code and grey to binary code.
4. Implementation of high pass and low pass filters.
5. Experiment to find the sum and average of N-numbers.
6. VI program to find the factorial of a given number.
7. VI program to compute the given expression.
8. VI program to implement 7-segment display.
9. Build a VI which consists of numeric input array. Set a threshold valve & separate the array elements which one greater than the threshold create an icon and connector and save this VI as sub VI.
10. Create a VI which consists of two string inputs. Find the length of each string input. Join the strings using concatenate string function. Find the length of the concatenated string.
11. Create a VI to read an analog input signal with noise through the data acquisition card and reduce noise analog measurement by averaging. arithmetic mean to average the signal put both the acquired signal and averaged signal and averaged signal. Also write the acquired signal in a file using write to measurement file. Express VI.
12. Create a VI to read the temperature data from a temperature sensor (LM35) fix a preset temperature whenever the preset valve, switch on a LED indication plot both acquired

temperature and preset temperature in a single waveform chart.		
Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19EIL61	**CO1**	Create VI program to implement combinational circuits.
	CO2	Develop VI program to implement filters.
	CO3	Create VI program to implement given arithmetic operations.
	CO4	Write VI program to generate seven segment display.
	CO5	Develop VI program to interface external devices.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		3				2	2		1	1	3	
CO2	3	3	3		3				2	1		1	1	3	
CO3	3	3	3		3				2	1		1	1	3	
CO4	3	3	3		3				2	1		1	1	3	
CO5	3	3	3	3	3				2	1		1	1	3	

Course Title: **Process Measurement and Process Control Lab**		
Course Code	19EIL62	CIE:50
Number of Practical Hours/Week	03 Hrs (Practical)	SEE: 50
	Credits: 01	SEE Hours: 03

Prerequisite : Control System and Process Control

Course Objectives :

1. To employ the flow measuring techniques
2. To demonstrate PID controllers for measurement
3. To design analog PID controllers
4. To understand the process of tuning and analyse system stability
5. Develop matlab programs for PID implementation

List of Experiments

1. Determine the coefficient of discharge of a given venturi-meter
2. Determine the coefficient of discharge of a orifice meter
3. Design analogue proportional controller using op amp
4. Design an analogue integral controller using op amp
5. Design an analogue two position controller using op amp
6. Demonstrate the action of proportional, proportional integral and proportional integral derivative controller using temperature control station
7. Demonstrate the action of proportional, proportional integral and proportional integral derivative controller using pressure control station
8. Demonstrate the action of proportional, proportional integral and proportional integral derivative controller using Flow control station
9. Write MATLAB program for P,PI and PID controllers for given transfer function
10.Write a MATLAB program to calculate gain margin and phase margin of a system using Bode plot
11.Demonstrate open loop transient tuning of a given transfer function using simulink
12.Demonstrate the ultimate cycle tuning using simulink software

Course outcomes :

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EIL62	**CO1**	Demonstrate the flow measuring technique.
	CO2	Design simple analog controller.
	CO3	Develop simple MATLAB program for PID controllers
	CO4	Demonstrate the P, PI and PID action using process control stations.
	CO5	Demonstrate the tuning technique using MATLAB software for simple transfer function.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1				2	1			3		
CO2	3	3	2	2	1				2	1			3		
CO3	3	3	2	2	1				2	1			3		
CO4	3	3	2	2	1				2	1			3		
CO5	3	3	2	2	1				2	1			3		

Course Title: Mini Project		
Course Code	19EIMP63	CIE:50
Number of Practical Hours/Week	03 Hrs (Practical)	SEE: 50
	Credits: 02	SEE Hours: 03

Course outcomes :
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EIMP63	**CO1**	Perform self-study and exhibit the skills of self learning by demonstrating knowledge on the topic selected for project work.
	CO2	Work as an individual or as a team member in addressing engineering problem or build an engineering project.
	CO3	Apply the acquired engineering skills to develop a prototype or simulate a model for environmental, social issues or engineering needs.
	CO4	Demonstrate the skill of collection of data and interpretation of data for effective decision making.
	CO5	Communicate technical results, information and conclusions to others by means of formal presentations, drawings and reports

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3	3		
CO2									3		3				
CO3	3	3	3		2	2	2					3	3	3	3
CO4				3	2										
CO5					1					3					