DR MAHALINGAM MCET COLLEGE OF ENGINEERING AND TECHNOLOGY
Enlightening Technical Minds

Dr. Mahalingam College of Engineering and Technology,Pollachi - 642003
(An Autonomous Institution)

ONE CREDIT COURSES

Curriculum & Syllabi (2015-2016)

About One Credit Course

The Value Added Education Courses aim to provide additional learner centric graded skill oriented technical training with the primary objective of improving the employability skills of engineering students of MCET.

There is a spectrum of ways in which practical technical skills can be developed through curricula. Here the plan is to bridge the perceived technical competency gaps of students by providing training in employability enhancing technical subjects through mandatory one credit courses and additional training through optional courses. The courses focus on skill development and more than 50% of the time is spent on practical training and problem solving, to provide the requisite understanding towards application of academic topics from engineering disciplines into real world engineering projects.

The main objectives of the program are:

- To provide students an understanding of the expectations of industry.
- To improve employability skills of engineering students of MCET.
- To bridge the skill gaps and make students industry ready.
- To provide an opportunity to students to develop inter-disciplinary skills.

Since the individual capabilities, aptitudes and needs of students vary widely, and since only 30 hours is available during regular contact hours for such value added courses, a two-pronged strategy is proposed to achieve the objectives outlined above.

It is proposed to conduct one credit courses of 30 hours duration each semester for four semesters, as part of the curriculum. Every student should opt for a minimum of four one credit courses. No additional fees or charges will have to be paid by the students for these mandatory courses.

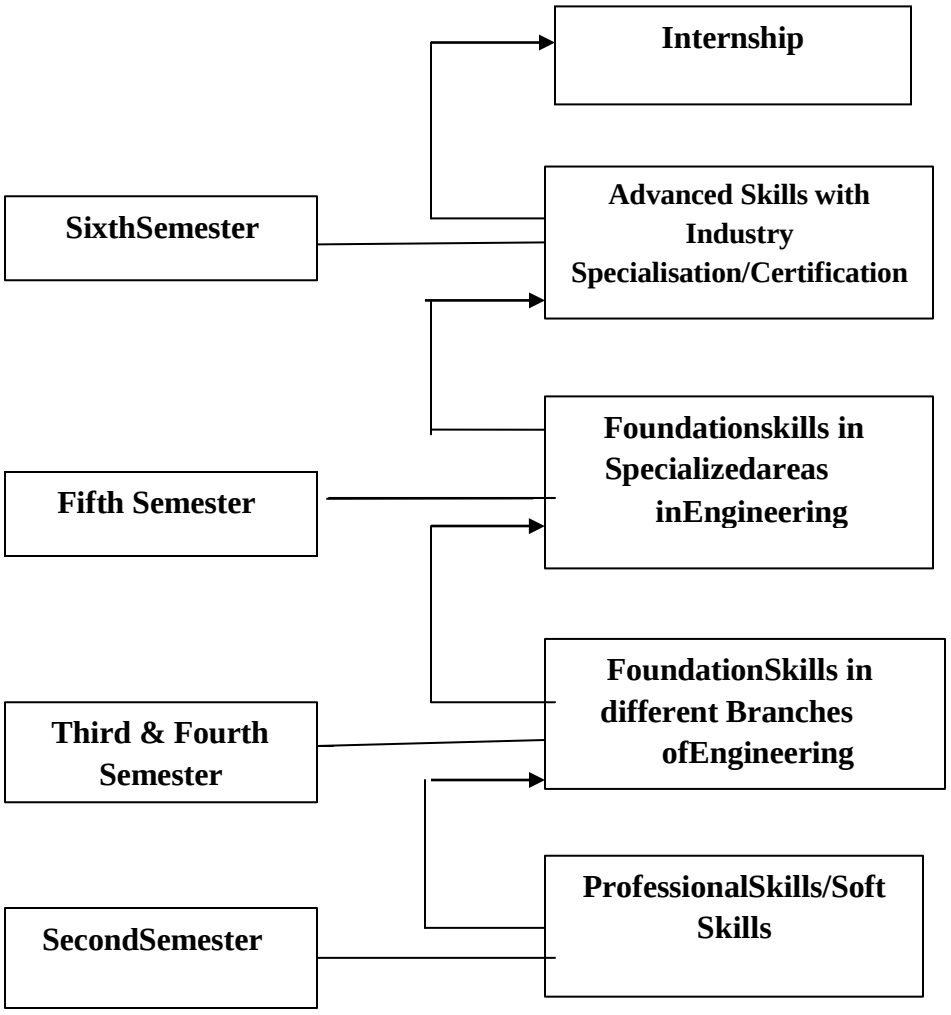
In addition to this, other **optional VAE courses** that will further improve the employability prospects of the students will be offered outside regular contact hours on optional basis, and interested students can join these courses by paying the fees fixed for it.

These courses will be offered as per clause 4.6 and 3.1.1 of UG and PG regulations respectively.

A VAE Course Management Committee shall be constituted for each stream, consisting of two HoDs from that stream as Stream Co-ordinator and Deputy Stream Co-ordinator respectively, the OCC Faculty Co-ordinator as Convener, the OCC Faculty Advisers of each Department under that stream and two student co-ordinators from each Department under that stream. This Committee shall meet atleast once every month to discuss the various issues related to Planning, Development and Conduct of OCC and VAE Courses of the concerned stream.

The scheme of assessment and distribution of marks for each course is decided by the course faculty, and the details shall be provided in the proposal for each course in the course design template. The system of evaluation shall normally be continuous internal assessment by the course faculty and there will be no end semester examination. An exam at the end of the course may be conducted by the course faculty, as proposed in the scheme of assessment for that course.

Framework for One Credit Courses (OCC)



COURSES OFFERED & SYLLABI – CIRCUITSTREAM (Odd Semesters)

Year/ Sem	Course Code	Name of the Course
II/III	140ER5111	Basic Electronic Circuit Design using Multisim
	140ER5112	Basic Electronic Components & System Design
	140ER5113	Electronic Circuit Design Using SPICE
	140ER5114	Fundamentals of MATLAB
	140ER5115	Open source programming using Linux
	140ER5116	PC Hardware Assembling &Troubleshooting
	140ER5117	PCB Design using Cadence EDA Tool
III/V	11ER011	Communication and Image processing using MATLAB
	11ER012	Digital System Design using VHDL
	11ER013	Embedded Programming using ARDUINO board
	11ER014	Embedded Programming using PIC Microcontrollers
	11ER015	Energy Auditing
	11ER016	Fundamentals of Networking
	11ER017	Industrial Automation
	11ER018	Introduction to Industrial Electrical System
	11ER019	Practical approach of Problem solving Techniques

140ER5111 BASIC ELECTRONIC CIRCUIT DESIGN USING MULTISIM

1. Title of the Course: Basic Electronic Circuit Design using Multisim

2. Aim:

To impart basic knowledge of circuit design using Multimim and SPICE

3. Prerequisites:

- Experience with Microsoft Windows
- Basic knowledge of Electronics theory

4. Course Outcomes:

At the end of this course, the students will be able to:

- Use Multisim to capture circuit schematics
- Use interactive simulation to check circuit design
- Perform circuit Analysis using SPICE

5. Teaching Strategies:

The teaching methodologies include lectures, presentations, circuit design, Simulation and mini-projects.

6. Syllabus:

UNIT I BASICS CIRCUIT SIMULATION TECHNIQUES IN MULTISIM 4+6 Hrs

MultiSim Environment: Design Process - Setting environment preferences - The Multisim GUI – Schematic capture of circuits : Placing components - Wiring components –simulation and result display in MultiSim

UNIT II ELECTRONIC CIRCUIT DESIGN USING MULTISIM 4+6 Hrs

Device modeling : Design of Bridge rectifier, Half-Wave rectifier, clippers and clampers using diode, voltage regulator , AC voltage measurement, DC transfer curve analysis.

UNIT III CIRCUIT MODELLING USING SPICE 4+6 Hrs

Spice Simulation overview –Design Environment- SPICE based simulator analysis – Real time applications

Theory : 12 Hrs
Practical : 18 Hrs
Total : 30 Hr

7. Course Plan:

S. No	Topic	Hours
	Unit-1	
1.	Introduction to MultiSim	**1**
2.	Design procedures	**1**
3.	Setting MultiSim simulation environment : Capture of schematics.	**1**
4	Simulation and result display	**1**
5.	Implementation of simple circuits	**6**
	Unit-2	
6	Work with design variants	**6**
7	Configuring application circuits	**1**
8	Analysis of circuits using MultiSim	**3**
	Unit-3	
9	Circuit design of Analog and Digital circuits	**1**
10	SPICE modelling and circuit analysis	**1**
11	Perform measurements and test on circuits	**1**
12	Comparison of simulated results with measured results of real circuit.	**1**
13	Design transfer to PCB layout	**6**

8. Course Assessment:

The course assessment is through Project Presentation.

S. No.	Criteria	Marks
1	Project Presentation	25

2	Complexity & implementation	25
Total		**50**

9. References:

1. Electronic devices and circuit theory by Robert L.Boylestad and Louis Nashelsky
2. http://www.eetimes.com/document.asp?doc_id=1272359
3. http://www.ecircuitcenter.com/Circuits/sbridge1/sbridge1.htm
4. http://www.ece.mtu.edu/labs/EElabs/EE3010/revisions/Summer2009/Multisim%20Tutorial/MULTISIM%20Tutorial.pdf

10. Resource Requirements:

Software requirement :MultiSim/SPICE Software

Equipments required: RPS, Electronic consumables, Bread board and connecting wires

140ER5112 BASIC ELECTRONIC COMPONENTS & SYSTEM DESIGN

1. Title of the Course : Basic Electronic Components & System Design

2. Aim:

To impart knowledge and provide hands on experience to design simple electronic circuits by understanding their characteristics.

3. Prerequisites:

Basic knowledge of semiconductor devices like diodes, transistors, resistors, capacitors, inductors is essential

4. Course Outcomes:

At the end of the course, the students will be able to:

- Become familiar with basic electronic circuits.
- Acquire experience in designing electronic circuits to perform real tasks.

5. Teaching Strategies:

Two 1½ hour sessions will be held each week. The first will be a lecture/discussion period devoted to presentation of theory and component description. Design procedures will also be presented. The second period each week will be devoted to laboratory exercises to reinforce theoretical concepts.

Short quizzes and homework problems will be assigned each week. Laboratory reports will be required. At the end of the semester, students will be required to design an electronic circuit to solve a realistic problem. The students will need to fabricate their designs and demonstrate their performances.

Laboratory exercises and reports will be worked in groups. Each person is expected to contribute fully to the efforts of the group. Each member of the group will sign each submission, and this signature will designate that the individual:

1) Contributed fully to the submission,
2) Know how to do all the work her- or himself, and
3) Attests that all other members of the group know how to do the work.

Group contributions will be assessed at the end of the course

6. Syllabus:

UNIT 1 **10**

Basic measuring instruments - Semiconductor devices and its applications – PN junction diodes, Zener Diodes, BJTs, FETs and UJT – simple Projects

UNIT II **1**

Op-amps basics – configurations, characteristics, linear and non-linear applications, special function ICs like IC 555 timer, LM 723 – simple projects

UNIT III **8**

Digital Logics: Basic gates and its applications, Special devices: Photo diodes, photo transistor, opto coupler basic operation and applications

Theory : 10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan:

S.No.	Content to deliver	Hours
1	Basic measuring instruments - Semiconductor devices and its applications – PN junction diodes, Zener Diodes, BJTs, FETs and UJT – simple Projects	10
2	Op-amps basics – configurations, characteristics, linear and non-linear applications, special function ICs like IC 555 timer, LM 723 – simple projects	12
3	Digital Logics: Basic gates and its applications, Photo diodes, photo transistor, opto coupler basic operation and applications.	8

8. Course Assessment:

S. No	Description	Max. Marks
1.	Quiz	10
2.	Laboratory report	10
3.	Design Project	30

4.	Final Evaluation	50
	Total Marks	100

9. References:

1. Electronic Devices and Circuits: David. A. Bell; Oxford University Press, 5th Edn, 2008.
2. Basic Electronics, RD Sudhaker Samuel, U B Mahadevaswamy, V. Nattarsu, Saguine-Pearson, 2007.
3. Handbook of Experiments in "Electronics Engineering", S. Poornachandra Rao and B.Sasikala, 1st Edn, Vikas Publishing House 2003.
4. "Electron Devices & Circuits" by Salivahanan et al.
5. "Electronics for You" – Reference Manual
6. www.circuitstoday.com
7. www.eleccircuit.com/easy-electronic-projects

10. Resource Requirements:

1. Classroom with projector facilities to show the animation / videos / PPT lectures etc.
2. Circuits and Devices Laboratory for three hours for project demonstration and exercises.
3. Furnished Laboratory with requisite consumables and equipment.

140ER5113 ELECTRONIC CIRCUIT DESIGN USING SPICE

1. **Title of the Course :** Electronic Circuit Design Using SPICE

2. **Aim:**
   To impart knowledge and provide hands-on experience in circuit development using PSPICE design tool

3. **Prerequisites:**
   - Basic knowledge on Electron Devices & Circuits
   - Fundamentals of Circuit Theory

4. **Course Outcomes:**
   At the end of the course, the students will be able to:
   - Gain expertise in Analog circuits design.
   - Understand functions and features of PSPICE and demonstrate its usage.
   - Understand fundamental electric circuit concepts.

5. **Teaching Strategies:**
   - Lecture
   - Lab Sessions

6. **Syllabus:**

   - Interaction of sub-circuits (e.g., Transfer function, Input & output resistance)
   - Frequency Response
   - Filters
   - Amplifiers basics
   - Oscillator Circuits
   - Concept and utility of Feedback
   - Diodes
   - BJT transistors
   - FET transistors (Large signal model, Digital Gates)
   - Simulate circuits using PSpice

Theory : 10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan

S. No.	Topic	Hours
1.	Introduction to PSPICE	
2.	Analysis of DC and AC circuits using **PSPICE**	
3.	Analysis of DC and AC circuits using **PSPICE**	
4.	Kirchhoff Voltage/Current Law	
5.	Measurement of DC voltages and currents	
6.	Measurement of DC voltages and currents	
7.	AC Signal Analysis	
8.	Measurement of AC signals	
9.	Transient Response	
10.	Transient analysis of RC and LR circuits	
11.	Frequency response of RC and LR circuits	
12.	Response of Higher Order Circuits + Transformer	
13.	Frequency response of higher order circuits	
14.	Transformer	
15.	pn Junction	
16.	Semiconductor diodes	
17.	Diodes in rectifier circuits	
18.	Diodes in rectifier circuits	
19.	BJT - Principles of Operation and configurations	
20.	Bipolar junction transistor	
21.	Bipolar junction transistor	
22.	BJT - Equivalent Circuit for Small Signals	
23.	BJT - Common Base, Emitter and Collector	
24.	BJT amplifier	
25.	BJT amplifier	
26.	BJT amplifier	
27.	MOSFET and operational amplifiers	
28.	MOSFET differential amplifier	
29.	Operational amplifiers	
30.	Operational amplifiers	

8. Course Assessment:

S. No.	Description	Marks
1	Project Design	50
2	Final Evaluation	50
3	Total	100

9. References:

- ORCAD PSpice for Windows, Vol. 1: DC and AC circuit," 3rd Edition by Goody
- A detailed primer for using PSpice with the Schematic graphical interface.
- "Fundamentals of Electrical Engineering," by Bobrow (2nd edition) Oxford University Press
- "Microelectronic Circuits," by Sedra and Smith (4th edition) (HRW)
- "Student manual for the Art of Electronics" by Hayes & Horowitz
- "Art of Electronics," by Horowitz & Hayes
- "Principles & Applications of Electrical Engineering" by Rizzoni

10. Resource Requirements:

- LTSPICE/ OrCAD SPICE Tool
- Computer System

140ER5114 FUNDAMENTALS OF MATLAB

1. **Title of the Course:** Fundamentals of MATLAB

2. **Aim :**

The aim of this course is to introduce the elements and practicalities of computer programming through the MATLAB mathematical computing environment.

3. **Prerequisites:**
   - Familiarity with Windows applications.
   - Basic Signals and their classifications.
   - Linear Algebra.

4. **Course Outcomes:**

After completing this course, the students will be able to use Matlab for analysis of circuits and systems.

5. **Teaching Strategies:**

S. No.	Description	Teaching Methods
1.	Overview of MATLAB	PPTs, Videos and programming Practices
2.	Programming in MATLAB	PPTs, Videos and programming Practices
4.	Functions	PPTs, Videos and programming Practices
5.	Animation and Sound in MATLAB	PPTs, Videos and programming Practices
6.	Simulink	PPTs, Videos and programming Practices

6. **Syllabus**

Unit I Overview of MATLAB **6**

MATLAB Interactive Sessions - Menus and the Toolbar - Arrays, Files, and Plots - Script Files and he Editor/Debugger - The MATLAB Help System – Problem Solving Methodologies- One and Two Dimensional Numeric Arrays - Multidimensional Numeric Arrays- Element by Element perations-Matrix Operations - Polynomial Operations Using Arrays- Cell Arrays - Structure Arrays.

Unit II Programming in MATLAB **6**

Program Design and Development - Relational Operators and Logical Variables – Logical Operators and Functions -Conditional Statements - for Loops - while Loops - The switch Structure- Debugging MATLAB Programs - Applications to Simulation.

Unit III Functions **6**

Elementary Mathematical Functions – User Defined Functions - Additional Function Topics -Working with Data Files- xy Plotting Functions - Additional Commands and Plot Types-Interactive Plotting in MATLAB – Three Dimensional Plots.

Unit IV Animation and Sound in MATLAB **6**

Creating Movies in MATLAB- Rotating 3D Surface- Animation with the Erase Mode Property- A Model of Sound-Creating Sound in MATLAB- Reading and Playing Sound Files.

Unit V Simulink **6**

Introduction to Simulink - Linear State-Variable Models -Piecewise-Linear Models – Transfer Function Models- Nonlinear State-Variable Models – Subsystems- - Simulation of a Nonlinear system.

Theory : 09 Hrs
Practical : 21 Hrs
Total : 30 Hrs

7. Course Plan

S. No.	Content to Deliver	Hours
1	MATLAB Interactive Sessions - Menus and the Toolbar - Arrays, Files, and Plots	2
2	Script Files and the Editor/Debugger - The MATLAB Help System	1
3	Problem Solving Methodologies- One and Two Dimensional Numeric Arrays - Multidimensional Numeric Arrays	2
4	Element by Element Operations-Matrix Operations - Polynomial Operations Using Arrays- Cell Arrays - Structure Arrays.	2
5	Program Design and Development - Relational Operators and Logical Variables	2
6	Logical Operators and Functions- Conditional Statements	2
7	for loops - while loops - The switch Structure- Debugging MATLAB Programs	2
8	Applications to Simulation.	1
9	Elementary Mathematical Functions – User Defined Functions- Additional Function Topics- Working with Data Files	2
10	xy Plotting Functions - Additional Commands and Plot Types	2
11	Interactive Plotting in MATLAB – Three	

	Dimensional Plots.	2
12	Creating Movies in MATLAB- Rotating 3D Surface	2
13	Animation with the Erase Mode Property	1
14	A Model of Sound-Creating Sound in MATLAB- Reading and Playing Sound Files.	2
15	Introduction to Simulink	1
16	Linear State-Variable Models -Piecewise-Linear Models	2
17	Transfer Function Models- Nonlinear State-Variable Models – Subsystems.	2

8. Course Assessment:

S.No	Assessment	Marks
1.	Assessment – 1 (Programming in MATLAB)	30
2.	Assessment – 2 (Functions and Plots)	40
3.	Assessment – 3 (Simulink)	30
	Total:	100

9. References:

- Essential MATLAB for scientists and engineers" by Brian D. Hahn, Arnold, 2001.
- MATLAB primer by Kermit Sigmon.
- www.mathworks.in/academia/student_center/tutorials/launchpad.html.
- Rudra Pratap "Getting Started with Matlab: A Quick Introduction for Scientists and Engineers" oxford university press 2010.
- Gilat "Matlab: An Introduction with Applications" Wiley India 2012.

10. Resource Requirements:

- PC with MATLAB Software
- Infrastructure required – Lab with projector facility.

140ER5115 OPEN SOURCE PROGRAMMING USING LINUX

1. Title of the Course: Open source programming using Linux

2. Aim:

To give introduction about basic file system and process commands in Linux operating systems.

3. Prerequisites:

- Basic knowledge in DOS and C programming

4. Course Outcomes:

At the end of the course, the students will be able to:

- Install Linux OS by partitioning the hard disk
- Manage files through file operation commands
- Control process through process commands

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	Linux introduction and file system	PPTs and Practices
2.	Commands for files and directories	PPTs and Practices
3.	Processes in linux	PPTs and Practices
4.	Shell programming	PPTs and Practices

6. Syllabus

Unit I Introduction 7Hrs

Linux introduction and file system–Basic features, advantages, installing requirement, basic architecture of UNIX/Linux system, Kernel, Shell.

Unit II Commands for Files and Directories 8 Hrs

Commands for files and directories cd, cp, mv, rm, mkdir,more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces, Essential linux commands.

Unit III Processes in Linux 8 Hrs

Processes in linux –process fundamentals,connecting processes with pipes,Redirecting input output,manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes , batch commands, kill, ps, who,sleep, Printing commands, grep, fgrep , find, sort, cal,banner, touch, file, file related commands–ws, sat, cut,grep, dd, etc.

Unit IV Shell Programming 7Hrs

Shell programming: Shell programming basic, various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, shell variables, shell keywords, creating simple shell programs.

Theory: 10 Hrs
Practical: 20 Hrs
Total: 30 Hrs

7. Course Plan:

Topic	Remarks	Hours
Basic features, advantages, installing requirement	PPT	2
basic architecture of UNIX/Linux system	PPT & Lab	3
Kernel, Shell.	PPT & Lab	2
cd, cp, mv, rm, mkdir ,, Essential linux commands.	PPT & Lab	2
creating and viewing files, using cat, file comparisons, View files,	PPT & Lab	2
disk related commands, checking disk free spaces	Lab	3
process fundamentals,connecting processes with pipes	PPT	3
Redirecting input output,manual help, Background processing	PPT	3
managing multiple processes, changing process priority,	PPT	3
Shell programming basic, various types of shell	PPT & Lab	1
shell programming in bash, conditional and looping statements,	PPT & Lab	2

case statements		
creating shell programs for automate system tasks and report printing	PPT & Lab	3
use of grep in shell, awk programming	PPT & Lab	1

8. Course Assessment:

S. No	Description	Max. Marks
1.	Installing Linux – Lab Exercise	20
2.	Linux commands Presentation	20
3.	Test on Linux Commands	30
5.	Practical Test –Shell Programming	30
	Total (A)	100/2 = 50
	Problem solving Skill - Interview(B)	20
	Online Test	30
	Total Marks (A+B+C)	100

9. References:

1. Linux: The Complete Reference, Sixth Edition ,Richard Petersen , 2008
2. http://www.linux.org/lessons/beginner/

10. Resource Requirements:

- Linux OS

140ER5116 PC HARDWARE ASSEMBLING & TROUBLESHOOTING

1. **Title of the Course:** PC Hardware Assembling & Troubleshooting.

2. **Aim:**
   This course imparts practical knowledge and provides hands-on experience in the area of how to assemble computers, and how to troubleshoot hardware and software issues.

3. **Prerequisites:**
   Basic knowledge of computer peripherals.

4. **Course Outcomes:**
   At the end of this course, the students will be able to:
   - Explain, install, and navigate an operating system, upgrade components based on customer needs and perform preventive measures and trouble shooting.
   - Assess customer needs, analyze possible configurations, and provide solutions or recommendations for hardware, operating systems, networking and security.

5. **Teaching Strategies:**
   - Group activities
   - Power point presentations and Video Presentations
   - Practical demonstrations

6. **Syllabus:**

Module I PCHardware **6**

BIOS settings-Motherboard Components– RAM– Expansion Cards– Storage Devices– The CPU– Interfaces– Computer Power– Custom Computer Components– Display Devices– Connector Types– Computer Peripherals

Module II Networking **6**

Network Connectors– Network Cabling– TCP/IP– Common Network Ports– Wireless Networking Standards– Installing a Wireless Router– Internet Connection Types– Network Types– Common Network Devices– Networking Tools

Module III Operating Systems **6**

Microsoft Operating Systems– Installing Windows– The Windows Command Line– Operating System Tools– The Windows Control Panel– Configuring Windows Networking– Windows Preventive Maintenance– Windows Security– Client-Side Virtualization

Module IV Laptops, Printers and Mobile Devices

Laptop – Hardware, Displays; Printers-Installing and maintenance; Mobile devices-Mobile Operating Systems-– Network Connectivity -Securing Mobile Devices-Mobile Device Synchronization

Module V Assembling and Troubleshooting **6**

Hardware assembling- Common Hardware Problems– Troubleshooting techniques of Devices- Hard Drive, Networks, Operating System, Laptops an TroubleshootingPrinters.

Theory : 10 Hrs
Practical : 10 Hrs
Total : 30 Hrs

7. Course Plan:

S. No	Topic	Period (Hrs)
Module I:	**PC Hardware**	
1.	BIOS settings-Motherboard Components– RAM– Expansion Cards Storage Devices–The CPU– Interfaces	1
2.	Computer Power– Custom Computer Components– Connector Types– Computer Peripherals	1
3.	Practical session on Assembling and verifying PC hardware	4
Module II:	**Networking**	
4.	Network Connectors– Network Cabling– TCP/IP– Common Network Ports Wireless Networking Standards– Installing a Wireless Router– Internet Connection Types	1
5.	Network Types– Common Network Devices– Networking Tools	1
6.	Practical session on installation of LAN and internet connection	4
Module III:	**Operating Systems**	
7.	Microsoft Operating Systems– Installing Windows– The Windows Command LineOperating System Tools– The Windows Control Panel– Configuring Windows Networking	1

8.	Windows Preventive Maintenance– Windows Security– Client-Side Virtualization	1
9.	Practical session on installation of OS	4
Module IV:	**Laptops, Printers and Mobile Devices**	
10.	Laptop – Hardware, Displays; Printers-Installing and maintenance Mobile devices- Mobile Operating Systems-– Network Connectivity	1
11.	Securing Mobile Devices-Mobile Device Synchronization	1
12.	Practical session on Peripheral interfacing	4
Module V:	**Assembling and Troubleshooting**	
13.	Hardware assembling- Common Hardware Problems Troubleshooting techniques of devices- Hard Drive, Networks	1
14.	Networks, Operating System, Laptops and TroubleshootingPrinter	1
15.	Practical session on Hardware assembling and Trouble shooting	4

8. Course Assessment :

S.No.	Description	Max.Marks
1.	**Assessment -1** • Presentation • Quiz	20
2.	**Assessment -2** Practical Exam	30
3.	**Total**	**50**

9. References:

- Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, James. K.L, PHI Publications.
- Troubleshooting your PC for dummies, Dan Gookin, Wiley Publishing Inc.
- Upgrading and Repairing PC's, Scott Muller
- http://www.professormesser.com/free-a-plus-training/free-a-plus/

10. Resource Requirements:

- Personal Computers, Laptops, projector, mobile phones and printers
- Lecture hall and laboratory

140ER5117 PCB DESIGN USING CADENCE EDA TOOL

1. Title of the Course

PCB Design Using Cadence EDA Tool

2. Aim:

To impart basic knowledge and provide hands –on experience in PCB layout and design.

3. Prerequisites:

- Electron Devices & Circuits.
- Circuit Theory.

4. Course Outcomes:

At the end of this course, the students will be able to gain knowledge about:

- Schematic drawing
- Circuit simulation
- PCB design

5. Teaching Strategies:

The teaching methodologies include lectures, group works, presentations and practicals.

6. Syllabus:

Module I Circuit creation using OrCAD Capture CIS 7

Introduction to PCB Design Flow-Tool bar – Customization – Library creation – Library customization – Editing part reference and value- Property editor- Wire and Net properties – Net alias, Editing parts , Creating parts, power symbol, part creation.

Module II Analog circuit design 7

Design of simple AC and DC Circuits using Cadence Allegro Design Entry CIS -Placing parts, editing parts, and wiring the circuit-Setting up the analysis-Bias point-DC Sweep-AC Sweep/Noise-Time Domain (Transient).

Module III Digital circuit design 5

Creation of simple Digital Circuits-Bus Creation.

Module IV PCB Layout Design 7

Footprint creation-Pad Design-PCB Symbol Creation-Net list-Placement-Routing- File Generation.

Module V Applications 4

Creation of simple circuits for real time applications.

Theory : 12 Hrs
Practical : 18Hrs
Total : 30Hrs

7. Course Plan:

S. No	Topic	Period (Hrs)
Module- I	**Circuit creation using OrCAD Capture CIS**	
1.	Introduction to PCB Design Flow-Tool bar – Customization	**1**
2.	Library creation – Library customization – Editing part reference and value- Property editor	**1**
3.	Wire and Net properties – Net alias, Editing parts , Creating parts, power symbol, part creation	**2**
4.	Lab	**3**
Module II	**Analog Circuit Design**	
5.	Design of simple AC and DC Circuits using Cadence Allegro Design Entry CIS -Placing parts, editing parts, and wiring the circuit	**1**
6.	Setting up the analysis-Bias point-DC Sweep-AC Sweep/Noise-Time Domain (Transient).	**1**
7.	**Lab**	**5**
Module III	**Digital Circuit Design**	
8.	Digital circuit creation, Bus Creation	**2**
9.	**Lab**	**3**
Module IV	**PCB Layout Design**	
10.	Footprint creation-Pad Design-PCB Symbol Creation-Net list	**1**
11.	Placement-Routing- File Generation.	**1**
12.	**Lab**	**5**
Module V	**Applications**	
13.	Creation of simple control circuits for real time applications	**2**

14.	**Lab**	**2**

8. Course Assessment:

S. No	Description	Max. Marks
Assessment 1		
1	Technical Quiz	25
Assessment 2		
2	Mini Project	25
	Total Marks	50

9. References

Printed Circuit Board Basics: An Introduction to the PCB Industry,Michael Flatt

- Integrity Issues and Printed Circuit Board Design ,Douglas Brooks
- Complete PCB Design Using OrCad Capture and Layout by Kraig Mitzner
- www.electronics-lab.com/PSPICE
- www.cadence.com/products/orcad/pspice_simulation
- www.electronics-lab.com/downloads/schematic/013/tutorial/PSPICE.pdf-OrCAD Users guide

10. Resource Requirements:

Equipments required: Personal Computers and projectors
Software required: Cadence ORCAD

11ER011 COMMUNICATION AND IMAGE PROCESSING USING MATLAB

1. **Title of the Course:** Communication and Image Processing using MATLAB

2. **Aim:**

   The coursewill impart knowledge on performing various image processing tasks using the Image Processing Toolbox and implementing various analog and digital modulation schemes using the Communication System Toolbox.

3. **Prerequisites:**
   - Familiarity with using Windows applications
   - Fundamentals of MATLAB

4. **Course Outcomes:**

   At the end of this course, the students will be able to:
   - Work comfortably with various image processing tasks
   - Implement various analog and digital modulation schemes
   - Create simple GUIs

5. **Teaching Strategies:**
   - Power point presentations
   - Demonstrations
   - Programming practices

6. **Syllabus:**

MODULE I: IMAGE PROCESSING

Introduction to Image Processing Toolbox, Image Import and Export, Image Types in the Toolbox - Converting Between Image Types, Process Multi-Frame Image Arrays, Reading Image Data, Writing Image Data to Files, Displaying and Exploring Images, Geometric Transformations.

MODULE II: COMMUNICATION SYSTEM

Introduction to Communication System Toolbox, Analog modulation – Amplitude and frequency modulation, Digital modulation – Amplitude, phase and frequency modulation, AM and FM using Simulink.

MODULE III: GUI

Creating a GUI – GUI for performing simple operations on an image –GUI for amplitude and frequency modulation.

Theory : 10 Hrs
Practical : 20 Hrs

Total : 30 Hrs

7. Course Plan:

S. No	Content to Deliver	No. of Lecture Hrs
Module - I		
1.	Introduction to Image Processing Toolbox, Image Import and Export, Image Types in the Toolbox	1
2.	Converting Between Image Types, Process Multi-Frame Image Arrays	3
3.	Reading Image Data, Writing Image Data to Files, Displaying and Exploring Images	2
4.	Geometric Transformations	4
Module- II		
5.	Introduction to Communication System Toolbox, Analog modulation – Amplitude and frequency modulation	3
6.	Digital modulation – Amplitude, phase and frequency modulation	4
7.	AM and FM using Simulink	3
Module- III		
9.	Creating a GUI	4
10.	GUI for performing simple operations on an image	3
11.	GUI for amplitude and frequency modulation.	3

8. Course Assessment:

S. No	Description	Max. Marks
1.	**Assessment-I** Project Report and Presentation	20
2.	**Assessment-II** Design Test using different toolbox	30
Total		50

9. References:

- MATLAB primer by Kermit Sigmon
- Digital Image Processing using MATLAB by Rafael Gonzalez, Richard Woods, Steven Eddins
- Digital Signal Processing Using MATLAB, Third Edition by Vinay K. Ingle, John G. Proakis
- www.mathworks.in/academia/student_center/tutorials/launchpad.html
- RudraPratap "Getting Started with Matlab: A Quick Introduction for Scientists and Engineers" oxford university press 2010

10. Resource Requirements:

- PC with MATLAB Software
- Projector

11ER012 DIGITAL SYSTEM DESIGN USING VHDL

1. **Title of the Course** : Digital System Design using VHDL

2. **Aim :**

   This course introduces the challenges, methodologies, techniques, and issues for designing digital systems using reprogrammable FPGA devices.

3. **Prerequisites:**

   - Digital Electronics.
   - C- Programming

4. **Course Outcomes:**

At the end of the course, the students will be able to:

- Understand the syntax and behavior of the VHDL language
- Use modern development tools to design complex digital circuits
- Simulate and make a synthesis of extensive designs in so called "Field Programmable Gate Array"

5.Teaching Strategies:

S.No	Description	Teaching Methods
1.	VHDL Programming	PPTs, Hands on training in lab session.
2.	FPGA Implementation	PPTs, Hands on training in lab session

6.Syllabus:

- Digital system design concepts
- Combinatorial and sequential logic design: principles and practices
- Sequential and combinatorial VHDL design
- Synchronous and asynchronous design
- Testbench development
- FPGA timing analysis
- FPGA power analysis

- CAD design software and emulation testbed
- Applications of FPGA in practical digital system development

Theory : 10 Hrs
Practical : 10 Hrs
Total : 30 Hrs

7.Course Plan:

S.No.	Content to deliver	Hours
1	Basic Constructs and Syntax of VHDL	3
2	Basic Concepts of Digital System Design	3
3	Behavioral design using VHDL	3
4	Combinational and Sequential Circuit Design using VHDL	3
5	Data flow and Structural design using VHDL	3
6	Writing Test Bench	3
7	FPGA Architecture & FPGA Implementation	3
8	Power Analysis	3
9	Timing Analysis	3
10	Project Development	3

8.Course Assessment:

S. No	Description	Max. Marks
1.	Practical Test 1. VHDL Simulation	50
2.	Practical Test 2. FPGA Implementation	50
	Total Marks	100

9.References:

- The Designer's Guide to VHDL. Peter J. Ashenden, 3rd edition, Morgan Kaufmann, 2008.
- The Student's Guide to VHDL. Peter J. Ashenden, 2nd edition, Morgan Kaufmann, 2008.
- Digital Design: An Embedded Systems Approach Using VHDL, Peter J. Ashenden, Morgan Kaufmann, 2008.
- FPGA-Based System Design, Wayne Wolf, Prentice Hall, 2004.

10. Resource Requirements:

Software : Xilinx ISE (Free Tool)
: Modelsim Simulator

11ER013 EMBEDDED PROGRAMMING USING ARDUINO BOARD

1. **Title of the Course:** Embedded programming using ARDUINO board
2. **Aim :**

   This course will familiarize the student with the basic principles and techniques of embedded programming using ARDUINO microcontroller boards and integrating them with sensor and actuator circuits.

3. **Prerequisites:**

   - Basics of Electronics Circuits
   - Microprocessor & Microcontroller
   - C Programming.

4. **Course Outcomes:**

At the end of this course, the students will be able to:

a. Utilize ARDUINO development kits effectively for embedded system design.
b. Gain experience with real time embedded system projects and working in a small team, cooperatingon various aspects of software development.
c. Understand development of embedded system applications.

5. **Teaching Strategies:**

   - Simulation and Demonstration
   - Power point presentation
   - Chalk and talk

6. **Syllabus:**

UNIT I

Microcontroller architecture-Signals –Operation features-Introduction to ARDUINO IDE Introduction to ARDUINO IDE-Introduction to Proteus-Introduction to I/O ports.

UNIT II

Interrupts-Serail communication _Memory organization _ Time/counters_ Programming using timers/counters_serial Communication Interface.

UNIT III

Analog to Digital I/O –Interfacing simple sensors – Key board interacing – 7segment Display –LCD interfacing –stepper Motor interfacing _DC motor interfacing.

Theory : 10 Hrs

Practical : 20 Hrs

Total: 30 Hrs

7. Course Plan:

No.of Hours	Lecture/Lab	Topic
1	Lecture	Microcontroller architecture
1	Lecture	Signals
1	Lecture	Operation features
1	Lecture	Interrupts
1	Lecture	Serial communication
1	Lecture	Memory organization
1	Lecture/Lab	Introduction to ARDUINO IDE
1	Lecture/lab	Introduction to ARDUINO IDE
1	Lecture/lab	Introduction to proteus
1	Lecture/lab	Introduction to proteus
1	Lecture	Introduction to I/O ports
1	Lecture /lab	Programming using I/O ports
1	Lecture /lab	Programming using I/O ports
1	Lecture	Timers/Counters
1	Lecture/lab	Programming using Timers /Counters
1	Lecture/Lab	Programming using Timers/Counters
1	Lecture	Serial Communication Interface
1	Lecture /lab	Serial Communication Interfacing
1	Lecture /Lab	Serial Communication Interface
1	Lecture	Analog to Digital I/O
1	Lecture/Lab	Interfacing simple sensors

1	Lecture/Lab	Interfacing simple sensors
1	Lecture/Lab	Key board interfacing
1	Lecture/Lab	7 Segment Display
1	Lecture /lab	LCD interfacing
1	Lecture /lab	Stepper Motor interfacing
1	Lecture /Lab	DC motor interfacing
1	Lecture /lab	Project Presentation
1	Lecture /lab	Project Presentation
1	Lecture /lab	Project Presentation

8. Course Assessment:

a. Written test (Fill in the blanks and objective type questions) for 25 Marks
b. Project development (as a team) for 25 Marks

9. References :

a. Programming Arduino Getting Started with Sketches by Simon Monk edition 2012
b. Make an Arduino Controlled Robot Paperback – 14 Mar 2013 by Michael Margolis
c. https://www.arduino.cc/

10 Resource Requirements:

d. Systems –PC's required as per the number of students
e. Software Tools – Proteus and ARDUINO IDE

140ER5120 EMBEDDED PROGRAMMING USING PIC MICROCONTROLLERS

1. **Title of the Course :** Embedded Programming using PIC Microcontrollers

2. **Aim:**

   This course will familiarize the student with the basic principles and techniques of embedded programming using PIC microcontroller and CCS Compiler.

3. **Prerequisites:**

   - Basics of Electronics Circuits
   - Microprocessor and Microcontroller
   - Basics of C Programming.

4. **Course Outcomes:**

   At the end of the course, the student will be able to:

   - Gain experience inworking in real time embedded system projects, and cooperating on various aspects of project development in a team.
   - Understand the interfacing of digital and analog I/O devices.
   - Understand modular multitasking embedded programming

5. **Teaching Strategies:**

   - ❖ Simulation and Demonstration
   - ❖ Power point presentation
   - ❖ Chalk and talk

6. **Syllabus:**

Unit I **9**

Introduction to Microcontrollers - Microcontroller PIC16F877A architecture - Introduction to PIC CCS Compilers - Introduction to PROTEUS - Introduction to I/O ports - Programming using I/O ports

Unit II **12**

LCD interfacing 7 Segment Display - Introduction to Timers/Counters - Programming using Timers/Counters - Programming using Timer0 - PWM Pulse Generation - Programming using PWM - DC Motor control - Analog to Digital I/O - Programming for ADC - Interfacing simple sensors

Unit III **9**

Key board interfacing - Stepper Motor interfacing - Serial Communication Interface – Programming for Transmit and Receive - Programming for Transmit and Receive - I2C bus interfacing - RTC Interfacing - External EPROM interfacing - GSM Modem interfacing

Theory: 12Hrs
Practical: 18 Hrs
Total: 30 Hrs

7. Course Plan:

Hours	Topic
1	Introduction to Microcontrollers
1	Microcontroller PIC16F877A architecture
1	
1	Introduction to PIC CCS Compilers
1	Introduction to PIC CCS Compilers
1	Introduction to PROTEUS
1	Introduction to I/O ports
1	Programming using I/O ports
1	Programming using I/O ports
1	LCD interfacing/7 Segment Display
1	
1	
1	Introduction to Timers/Counters
1	Programming using Timers/Counters
1	Programming using Timer0
1	PWM Pulse Generation

1	Programming using PWM
1	DC Motor control
1	Analog to Digital I/O
1	Programming for ADC
1	Interfacing simple sensors
1	Key board interfacing
1	Stepper Motor interfacing
1	Serial Communication Interface
1	Programming for Transmit and Receive
1	Programming for Transmit and Receive
1	I2C bus interfacing
1	RTC Interfacing
1	External EPROM interfacing
1	GSM Modem interfacing

8. Course Assessment :

Written test (Fill in the blanks and objective type questions) = 25 Marks
Project development (as a team) = 25 Marks
Total = 50 Marks

9. References:

- Reference book is Embedded C Programming and the Microchip PIC by BARNETT.
- Design with PIC microcontrollers by John B.Peatman
- The 8051 Microcontroller and Embedded Systems Using Assembly and C by Mazidi. Pearson Education
- Web Resources/links www.microchip.com/pic
- Web Resources/links www.keil.com/uvision

10. Resource Requirements:

- Systems –PC's required as per the number of students
- Software Tools – Proteus and CCS Compiler

11ER015 ENERGY AUDITING

1. **Title of the Course and Number:** Energy auditing

2. **Aim:**

   To impart basic knowledge on energy auditing and energy conservation

3. **Prerequisites:**
   - Circuit Theory
   - Electrical Machines I & Electrical Machines II.
4. **Course Outcomes:**

   At the end of the course, the students will be able to
   - Conduct energy audit in industry
   - Use various energy conservation techniques for improving energy efficiency.

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	Energy management approach	PPTs by case study
2.	Energy audit instruments	Hands on experience in the lab
3.	Sample energy audit	PPTs by case study

6. Syllabus:

Unit I Energy Scenario (8)

Commercial and Non -commercial energy, primary energy resources, Indian energy scenario, energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Unit II Energy audit definition & types (7)

Electricity basics, Definition, energy audit, need, types of energy audit.Energy management (audit) approach -energy audit instruments and metering.

Unit III Financial & Project Management (8)

Financial analysis techniques-Definition and scope of project implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification.

Unit IV Energy Efficiency In Electrical Utilities (7)

Electrical systems-Lighting System-Electric motors-Energy conservation in Buildings.

Theory: 10 Hrs
Practical: 20 Hrs
Total: 30 Hrs

7. Course Plan:

S.No	Content to Deliver	No. of Lecture Hrs	Remarks
1.	Commercial and Non -commercial energy	1	Power point presentation
2.	Primary energy resources	1	Power point presentation
3.	Indian energy scenario	1	Power point presentation
4.	Need of energy in growing economy	1	Power point presentation
5.	Energy intensity in various sectors	1	Power point presentation
6.	Long term energy scenario	1	Power point presentation
7.	Energy pricing	1	Power point presentation
8.	Energy security	1	Power point presentation
9.	Energy conservation and its importance	1	Power point presentation
10.	Energy strategy for the future	1	Power point presentation
11.	Electricity - Basics, Definition and related terms	1	Power point presentation
12.	Energy audit- Need and its definition	1	Power point presentation
13.	Types of energy audit	1	Power point presentation
14.	Energy management	1	Power point presentation
15.	Audit approach techniques	1	Power point presentation
16.	Energy audit instruments- Operating principle	1	Power point presentation
17.	Energy audit metering	2	Will be given basic

			knowledge about the instrument
18.	Financial analysis techniques	1	Power point presentation
19.	Definition related to different techniques followed	1	Power point presentation
20.	Scope of project implementation plan for top management	1	Power point presentation
21.	Planning Budget	1	Power point presentation
22.	Procurement Procedures	1	Power point presentation
23.	Construction Procedures	1	Power point presentation
24.	Measurement & Verification techniques	1	Power point presentation
25.	Electrical systems and its related problems	1	Power point presentation and Classroom teaching
26.	Lighting System- Types, Calculation of lux for various schemes	1	Power point presentation
27.	Lighting system – Related problems	1	Power point presentation and classroom teaching
28.	Electric motors and efficiency calculation	1	Power point presentation and Classroom teaching
29.	Energy conservation in Buildings- Techniques and problems	1	Power point presentation and Classroom teaching

8. Course Assessment:

S. No	Description	Max. Marks
1.	Case study 1	25
2.	Case study 2	25
Total (A)		50

Aptitude Test(B)	50
Total Marks (A+B)	100

9. References :

www.energymanagertraining.com
www.em-ea.org
www.aipnpc.org
Study material from national productivity council

10. Resource Requirements:

Power electronics lab & Energy and Power Quality audit meters

11ER016 FUNDAMENTALS OF NETWORKING

1. **Title of the Course:** Fundamentals of Networking

2. **Aim:**
   - To impart knowledge in the basics of computer networking.
3. **Prerequisites :**
   - Computer Networks, Basics of computer Hardware

4. **Course Outcomes:**
   At the end of the course ,the students will
   - Become familiar with layered communication architectures (OSI and TCP/IP).
   - Develop practical Networking Knowledge and skills in professional environment.

5. **Teaching Strategies:**
   - Lecture
   - Lab work
   - Simulation using Network Simulators
   - Project Presentations

5. **Syllabus:**

Module 1:

Basic Networking Knowledge and Practice- Introduction to Networking Software-OPNET, Creating Hub, Switches and comparing the performance, Implementation of different Topologies-bus,star,ring.

Module 2:

LAN and Internet- Wired and Wireless, Design and Implementation of Switched LAN Networks, performance of different implementations of local area networks –small scale, medium scale applications.

Module 3:

Network Routing -IP addressing and sub netting, queuing discipline,Connection oriented and Connectionless services, Congestion Control Algorithms.

Module 4:

Introduction to Qualnet -Network Routing, Energy modeling, Security-Network Attacks, Encryption and Decryption.

Module 5:

Introduction to NS2 - Sample programs, wired and wireless network, post processing filters, analysis of network parameters-throughput, packet delivery ratio, end to end delay, jitter.

Theory : 10 Hrs
Practical : 20 Hrs

Total : 30 Hrs

7. Course Plan:

Hours	Lecture/Lab	Topic
1 1 1	Lecture	Introduction-Basics of Computer Network Basic Hardware Components , network topology, Introduction to Networking Software- Riverbed Modeler Academic Edition Software Installation Procedure and obtaining License.
1 1 1	Lecture /lab	Simulating Bus, Ring Topologies. Creating Hub ,Switches and comparing the performance of pure hub LAN with switched LAN in a network.
1 1 1	Lecture/Lab	Design and Implementation of Switched LAN Networks, small scale, medium scale applications.
1 1 1	Lecture/lab	RIP, Network Routing –IP addressing and subnetting,queuingdiscipline, Demonstration of the congestion control algorithms implemented by theTransmission Control Protocol (TCP)
1 1 1	Lecture/lab	Wireless Networks-MANET,Wireless Sensor Networks
1 1 1	Lecture/Lab	Introduction to Networking Software-Qualnet, Network Routing, Energymodeling.
1 1 1	Lecture /Lab	Security-Network Attacks, Encryption and Decryption.Creating Scenario and introducing attack. Analyzing the performance of the network with and without attack
1 1 1	Lecture/Lab	Introduction to NS2- Sample programs, wired network, analysis of network parameters
1 1 1	Lecture /Lab	Wireless networks, post processing, parameter analysis.
1 1 1	Lecture/Lab	Project development - Interaction within the group ,Write/compile document for presentation

8. Course Assessment:

- Project presentation.

Criteria	Marks
Presentation	20

Project Complexity	20
Originality	10
Total	**50**

9. References :

- Andrew S. Tanenbaum, "Computer Networks", 4th ed., Prentice Hall, 2003.
- William Stallings, “Data and Computer Communications,” 5th edition, PHI, 2005
- OPNET Technologies, “IT Guru Quick Start” (PowerPoint Presentation), from OPNET Training Manual, (OPNET Technologies,Inc, 2004).
- http://www.cs.binghamton.edu/~vinkolar/qualnet/QualNetTutorial.pdf
- http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf

10. Resource Requirements:

- Systems –PC’s required as per the number of students.
- Software Tools – Qualnet,Riverbed Modeler Academic Edition,NS2.

11ER017 INDUSTRIAL AUTOMATION

1. **Title of the Course:** Industrial Automation

2. Aim:

To impart knowledge in automation technologies used in Process Industries, Automotive Industries, Home, Factory, Agriculture etc.

3. Prerequisites:

- Basic knowledge in hydraulics and pneumatics
- Basic knowledge in Analog/Digital circuits and electrical drives
- Principles and operations of sensors and transducers Basic
- knowledge in microprocessor based systems

4. Course Outcomes:

At the end of the course, the student will be able to:

- Understand the basics of hydraulics, electro hydraulics and its circuits
- Understand the basics of pneumatic, electro pneumatics and its circuits
- Develop an automation system with suitable sensors
- Develop PLC software for simple automation applications
- Interface electrical drives and sensors with PLC

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	Hydraulics and Electro Hydraulics	PPTs, Videos and Practices using Hydraulic Instruments
2.	Pneumatics and Electro Pneumatics	PPTs, Videos and Practices using Pneumatic Instruments
4.	Sensorics	PPTs and Practices on different Sensors
5.	PLC	PPTs Practices on Rexroth PLCs
6.	Mechatronics	PPTs, Videos and Practices on Bosch Mechatronics System

6. Syllabus:

Unit I HYDRAULICS 6

Basics of Hydraulics - Components of hydraulics - Types of valves – DCVs - operations - hydraulic Circuits – Electro hydraulics - Solenoids - Relays - Electrical logic circuits - Applications of electro hydraulics - Practices on electro hydraulic circuits.

Unit II PNEUMATICS 6

Basics of Pneumatics - Components of Pneumatics - Types of valves - DCVs - operations - Pneumatic circuits – Electro pneumatics - Electrical Logic circuit – Relay ladder logic - Applications of electro pneumatics - Practices on electro pneumatic circuits.

Unit III SENSORICS 5

Introduction to sensorics - Closed loop system - Types of Proximity sensors - construction - principle of operation - Applications proximity sensors - electrical connections - Practices on all types of proximity sensors

Unit IV PLC TECHNOLOGY 10

Introduction to PLC H/W - Architectural evolution - Role of PLC in Automation - Ladder Logic - Basics of digital logic - Latching - Selections of PLC - Practices on Ladder logic using PLC.

Unit V MECHATRONICS 3

Introduction to Mechatronics system – over view of Automation System – Types of Automation– role of sensors in automation system – Electrical drives – interfacing of PLC – Case study of modular Mechatronics System (mMs) – Demonstration of mMs - Troubleshooting of mMs

Theory : 10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan:

No of Day	No. of Lecture Hrs	Content to Deliver	Remarks
1	2	Basics of Hydraulics, Components and types of valves, Solenoids and relays	PPT (Class Room)
	2	Practices on Hydraulic circuits and Electro Hydraulic circuits	Lab
	2	Practical Test – Hydraulic/Electro Hydraulic circuits	Lab
2	2	Basics of Pneumatics, Components and types of Directional control valves	PPT (Class Room)
	2	Practices on Pneumatic circuits and Electro Pneumatic circuits	Lab
	2	Practical Test – Pneumatic/Electro Pneumatic circuits	Lab
3	2	Concept of control systems and Different types of sensors	PPT (Class Room)
	1	Practices on different types of proximity sensors	Lab
	2	Practical test electrical connection, testing and performance analysis	Lab
4	2	Overview of PLC, H/W structure	PPT

			(Class Room)
	2	Basic digital logic and relay ladder logic	PPT (Class Room)
	4	PLC Programming – LD and ST	Lab
	1	Test on PLC Programming	Lab
5	2	Overview of Automation systems, role of sensors and electrical drives	PPT (Class Room)
	1	Demo – Mechatronics System	Lab

8. Course Assessment:

S. No	Description	Max. Marks
1.	Practical Test – Hydraulics	20
2.	Practical Test – Pneumatics	20
3.	Practical Test – Sensorics	20
4.	PLC Programming	20
5.	Practical Test – Mechatronics	20
	Total (A)	100/2 = 50
	Aptitude Test(B)	20

Mini Project (C)	30
Total Marks (A+B+C)	100

9. References:

1. Bosch Rexroth User Manuals
2. W. Bolton “Mechatronics” PHI, 2010
3. www.boschrexroth.com/en/xc/training/elearning/elearning

10. Resource Requirements:

MCET-Bosch Rexroth Centre of Competence

11ER018 INTRODUCTION TO INDUSTRIAL ELECTRICAL SYSTEM

1. **Title of the Course**: Introduction to Industrial Electrical System

2. **Aim:**

To bring the awareness in the students regarding latest trends in electrical industry in the field of switchgears & protection and provide them with hands-on experience

3. **Prerequisites:**

Knowledge of basic concepts of electrical engineering

4. **Corse Outcomes:**

At the end of the course, the students will able to:

- Acquire good knowledge & overview of latest switchgears products
- Gain knowledge on the protective systems which is prevalent in the modern industry.

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	a. Electrical Safety, b. LV Switchgear c. Various examples of LV switchgear d. Motor starters e. Electrical Protection systems f. Different unit Protection	PPTs, Discussions & Explanation during class room sessions, co-relation with latest trends in modern industry
2.	a. Various LV switchgear b. Motor starters c. Protection Relays	Hands on experience in the lab, various experiments, testing, demonstration etc.

6. **Syllabus:**

Unit I 20

Importance & Selection of LV switchgear - Electrical safety, various LV switchgear their importance, operation, selections, applications, features, maintenance etc.Workshop session, Hands on practice, Demonstration on above

Unit II 10

Electrical Protection Systems - Concepts of electrical protection system, Overview of Advance Electrical Protection System, various components of protection systems, Feeder Protection Relays, Motor Protection Relays, Workshop session, Hands on practice, Demonstration on above relays

Total: 30 Hrs

7. CoursePlan:

S.No.	Content	Hours
1.	Importance of Electrical Safety,	1
2.	Overview of Power Generation, Transmission & Distribution in India	1
3.	Industrial Power Distribution System	1
4.	Study of LV Switchgear: AC Contactors	1
5	Study of LV Switchgear: AC Contactors	1
6.	Study of Overload Relays	1
7.	Motor Starting Techniques	1
8.	Motor Starters	2
9.	Study of Overload Relays	1
10.	Motor Starting Techniques	1
11.	Study of LV Switchgear: HRC Fuses	1
12.	Study of LV Switchgear: Switch Fuse Unit	1
13.	Study of LV Switchgear: MCCB	1
14.	Study of LV Switchgear: ACB	1
15.	Hands on session : Study of LV Switchgear: HRC Fuses	2

16.	Hands on session : Study of LV Switchgear: Switch Fuse Unit	2
17.	Hands on session : Study of LV Switchgear: MCCB	2
18.	Hands on session : Study of LV Switchgear: ACB	2
19.	Concepts of electrical protection system,	1
20.	Overview of Advance Electrical Protection System,	1
21.	various components of protection systems	1
22.	Feeder Protection Relays	1
23.	Motor Protection Relays	1
24.	Feeder Protection Relays	1
25.	Motor Protection Relays	1

8. Course Assessment :

S. No	Description	Max. Marks
1.	Post Course Test	50
	Total	50

9. References:

Study material from L&T Switchgear Training Centre

10. Resource Requirements:

Laboratory equipped with necessary switchgear, test jigs, meters & equipments.

11ER019 PRACTICAL APPROACH OF PROBLEM SOLVING TECHNIQUES

1. **Title of the Course:** Practical approach of Problem solving Techniques

2. **Aim:**
   To impart knowledge in problem-solving method for developing an algorithmic solution to a problem

3. **Prerequisites**
   - Basic knowledge in Mathematics.
   - Basic knowledge in Programming.

4. **Course Outcomes:**
   At the end of the course, the students will be able to:
   - Articulate a problem including assumptions and definitions.
   - Identify and employ techniques for generating possible solutions.
   - Defend the choice of a solution against alternatives**.**

5. **Teaching Strategies:**

S.No.	Description	Teaching Methods
1.	Introduction to Problem Solving	PPTs and Practices
2.	Algorithm development and Description	PPTs and Practices
3.	Flowchart – Implementation of algorithm	PPTs and Practices
4.	Programming Style and Efficiency	PPTs and Practices

6. **Syllabus:**

UNIT I **10 hrs**

Software Engineer Skills – Problem – Solving a Problem: Understand the Problem, Formulate a Model, Develop an Algorithm, Write a Program, Test a Program, Evaluate the Solution. Problem Classification – Logic – Importance of Logic in Problem Solving-Types of Logic

UNIT II **10 hrs**

Programming life cycle phases – problem solving – implementation – maintenance – pseudo code representation – flow charts - RAPTOR- algorithms – algorithmic efficiency – complexity of algorithms – Testing

Unit III **10 hrs**

Arguments to main - Environment variables - Library functions getenv, putenv and the global variable environ – Recursion - Functions with a variable number of arguments - The library function system - The library macro assert -The library function perror and global variable errno - The atexit function - qsort, bsearch – Reallocation - Pointer to structures

Theory : 9 Hrs
Practical : 21 Hrs
Total : 30 Hrs

7. Course Plan:

Hours	Content to Deliver	Remarks
2	Software Engineer Skills –Problem – Solving a Problem - Problem Classification – Logic – Importance of Logic in Problem Solving- Types of Logic	PPT
3	**Case Study: Different types of Computational Problem:** ATM System, Bill Processing System	PPT & Lab
2	**Case study:** **Solve the Problem**: Grading System **Logic:** Determine whether a given number is prime or not	PPT & Lab
2	Pseudo code - Properties of Algorithm- Patterns in Algorithm- Problem solving through Algorithms	PPT
5	**Case Study:** **Algorithm writing for different pattern of algorithms**- Grading System	PPT & Lab
2	Implementation of Algorithm using Flow Chart- RAPTOR - Problem solving through Flow chart	PPT
5	**Case Study:** **Raptor:** Grading System	PPT & Lab
3	Problem solving using a functional style - correctness issues in programming – Iterative Versus Recursive	PPT

	style- efficiency issues in programming - time and space measures - Testing	
6	**Case Study:** Grading System	PPT & Lab

8. Course Assessment:

S. No.	Description	Marks
1.	Solving a Problem - Assignment	5
2.	Logic for a Problem - Preparation and Presentation	5
3.	Algorithm Development (Step wise Execution) - Description - Assignment	30
4.	Practical Test – Raptor	30
5.	Practical Test -Implementation and Testing	30
	Total (A)	100/2 = 50
	Problem solving Skill - Interview(B)	20
	Online Test	30
	Total Marks (A+B+C)	100

9. References:

1. Dormey R G. How to Solve it by Computers, PH 2005
2. Infosys Campus Connect Foundation Programme - Problem Solving Techniques
3. http://mitpress.mit.edu/sicp/full-text/book/book-Z-H-4.html
4. Byron S. Gottfried: Theory and Problems of Programming with C Language, Schaum Series, Tata Mcgraw Hill

10. Resources Requirements:

TURBO C, RAPTOR

COURSES OFFERED & SYLLABI – CIRCUIT STREAM (Even Semesters)

Year/ Sem	Course Code	Name of the Course
II/IV	140ER5118	Basics Of LabVIEW
	140ER5119	Electronic System Design
	140ER5120	Embedded Programming Using PIC Microcontroller
	140ER5121	Embedded system based design of power electronic drives
	140ER5122	Industrial Automation
	140ER5123	New and Renewable Energy Technologies
	140ER5116	PC Hardware Assembling &Troubleshooting
	140ER5124	PCB Designing using PCB Express
	140ER5125	Project Development using C
	140ER5126	Speech and Audio Signal Processing using MATLAB
III/VI	11ER020	Automotive Electrical and Electronics
	11ER014	Embedded Programming Using PIC Microcontroller
	11ER017	Industrial Automation
	11ER021	Instrumentation System Design
	11ER018	Introduction to Industrial Electrical System
	11ER022	Mobile Application Development
	11ER023	Programming with PLC and HMI
	11ER024	RF Circuit Design using ADS

140ER5118 BASICS OF LABVIEW

1.Title of the Course : Basics of LabVIEW

2.Aim:

This course prepares the students to develop test and measurement, data acquisition, instrument control, data logging, and measurement analysis applications using LabVIEW.

3. **Prerequisites:**

Basic Programming Skills in C

4. Learning Outcomes:

At the end of this course, the students will be able to:

- Understand front panels, block diagrams, icons, and connector panes
- Create user interfaces with charts, graphs and buttons
- Use the programming structures and data types that exist in LabVIEW
- Use various editing and debugging techniques
- Create and save VIs for use as subVIs
- Display and log data
- Create applications that use data acquisition (DAQ) devices
- Create applications that use GPIB and serial port instruments
- Use the state machine design pattern in various applications
- Use local variables to modify front panel controls or stop parallel loops

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	LabVIEW programming Concepts	PPTs and Videos
2.	LabVIEW programming Examples and Exercises	Practicals

6. Syllabus:

UNIT I:

Data and Data Types in general programming- LabVIEW Basics: Front Panel, Block Diagram, Icon and Connector, control, function and Tools Palette- Front Panel controls-subVI

UNIT II:

Data Flow programming, Parallelism- Block Diagram functions: Numeric, String, Boolean, Comparison- Structure: For, While, Event Structure, Flat and Sequence Structure, Timing functions.

UNIT III:

Array and Cluster- Charts and Graphs- Property Node and Invoke Node-File IO- Synchronization-Introduction to DAQ.

Theory:4 Hrs
Practical:26 Hrs
Total :30 Hrs

7. Course Plan:

S. No.	Topic	Hours
1	Data and Data Types in general programming	1hr
2	LabVIEW Basics: Front Panel, Block Diagram, Icon and Connector, control, function and Tools Palette.	2 hrs
3	FP controls.	1 hr
4	Data Flow programming, Parallelism.	1 hr
5	BD functions: Numeric, String, Boolean, Comparison	1 hr
6	Structure: For, While, Event Structure, Flat and Sequence Structure, Timing functions.	6 hrs
7	Array and Cluster	3 hrs
8	Charts and Graphs	3 hrs
9	Property Node and Invoke Node.	3 hrs
10	File IO	3 hrs
11	Synchronization	3 hrs
12	DAQ	3 hrs
	Total	30 hrs

8. Course Assessment:

S. No	Description	Max. Marks
1.	Programming Assignments	25
2.	Practical Test at the end of the Course	25
	Total Marks	50

9. References:

1. Gary W Johnson, Richard Jennings, 'LabVIEW Graphical Programming' Fourth Edition, McGraw Hill, 2006.
2. Robert H Bishop. 'Learning with LabVIEW 2009' Pearson Education, 2010.
3. http://www.forums.ni.com

10. Resource Requirements:

PC with LabVIEW Software

140ER5119 ELECTRONIC SYSTEM DESIGN

1. **Title of the Course :**Electronic System Design
2. **Aim:**

   This course imparts basic knowledge in circuit design and provides hands-on experience in using Multisim Software.

3. **Prerequistes:**

   The student must have knowledge on

   - RLC circuits
   - Transistors
   - OPAMP
   - Logic gates

4. **Course Outcomes:**

   At the end of this course, the student will be able to:

   - Do basic Electronic circuit designs, and develop capability to do mini projects
   - Apply practical knowledge to a range of standard Basic electronic subsystems
   - Design and analyse the behavior of standard Basic electronic subsystems

5. **Teaching Strategies**
   - Group activities
   - Power point presentations and Video Presentations
   - Simulation of Designs
   - Practical demonstrations
6. **Syllabus:**

Module I **8**

Introduction to multisim software and basic electronic system design, Design of an Instrumentation Amplifier,Design of Voltage Regulator Using SCR, Design of Flashing LEDs, Design of simple alarm using Multisim.

Module II **7**

Design of opamp filters - low pass and high pass, Frequency Response of the Basic Op Amp Circuit using Multisim , Design of automatic light switch circuit using multisim.

Module III 8

Design of logic gates using transistor**,** design of sequence detector**,**Digital display using asynchronous counter, Design of water level indicator.

Module IV **7**

Process control timer, 4 way traffic light controller, Design of simple UPS

Theory : 10 Hrs

Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan:

S. No	Topic	Hours
Module- I		
1	Introduction to multisim and basic electronic system design	2
2	Design of an Instrumentation Amplifier	2
3	Design of Voltage Regulator Using SCR	2
4	Design of Flashing LEDs, Design of Simple alarm using Multisim.	2
Module II		
5	Design of opamp filters - low pass and high pass	3
6	Frequency Response of the Basic Op Amp Circuit	2
7	Design of automatic light switch circuit	2
Module III		
8	Design of logic gates using transistor	2
9	Design of sequence detector	2
10	Digital display using synchronous counters	2
11	Design of water level indicator	2
Module IV		
12	Process control timer	2
13	4 way traffic light controller	2
14	Design of simple UPS	3

8. Course Assessment:

S.No	Description	Max.Marks
1.	Written Test	20
2.	Mini project presentation	30
	Total	**50**

9. References:

- Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
- John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
- Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.
- Ranakant.A.Gayakward,OPAMP and Linear Integrated Circuits, Fourth Edition,Pearson Education.
- http://circuiteasy.com/logic-gates/
- http://www.facstaff.bucknell.edu/mastascu/elessonshtml/Logic/Logic1.html

10. Resource Requirements:

Equipments required : Personal Computers, projector, Basic electronic components

Software Required : Multisim

140ER5120 EMBEDDED PROGRAMMING USING PIC MICROCONTROLLERS

1. Title of the Course : Embedded Programming using PIC Microcontrollers

2. Aim:

This course will familiarize the student with the basic principles and techniques of embedded programming using PIC microcontroller and CCS Compiler.

3. Prerequisites:

- Basics of Electronics Circuits
- Microprocessor and Microcontroller
- Basics of C Programming.

4. Course Outcomes:

At the end of the course, the student will be able to:

- Gain experience inworking in real time embedded system projects, and cooperating on various aspects of project development in a team.
- Understand the interfacing of digital and analog I/O devices.
- Understand modular multitasking embedded programming

5. Teaching Strategies:

- ❖ Simulation and Demonstration
- ❖ Power point presentation
- ❖ Chalk and talk

6. Syllabus:

Unit I **9**

Introduction to Microcontrollers - Microcontroller PIC16F877A architecture - Introduction to PIC CCS Compilers - Introduction to PROTEUS - Introduction to I/O ports - Programming using I/O ports

Unit II **12**

LCD interfacing 7 Segment Display - Introduction to Timers/Counters - Programming using Timers/Counters - Programming using Timer0 - PWM Pulse Generation - Programming using PWM - DC Motor control - Analog to Digital I/O - Programming for ADC - Interfacing simple sensors

Unit III **9**

Key board interfacing - Stepper Motor interfacing - Serial Communication Interface – Programming for Transmit and Receive - Programming for Transmit and Receive - I2C bus interfacing - RTC Interfacing - External EPROM interfacing - GSM Modem interfacing

Theory: 12Hrs

Practical: 18 Hrs
Total: 30 Hrs

7. Course Plan:

Hours	Topic
1	Introduction to Microcontrollers
1	Microcontroller PIC16F877A architecture
1	
1	Introduction to PIC CCS Compilers
1	Introduction to PIC CCS Compilers
1	Introduction to PROTEUS
1	Introduction to I/O ports
1	Programming using I/O ports
1	Programming using I/O ports
1	LCD interfacing/7 Segment Display
1	
1	
1	Introduction to Timers/Counters
1	Programming using Timers/Counters
1	Programming using Timer0
1	PWM Pulse Generation
1	Programming using PWM
1	DC Motor control
1	Analog to Digital I/O
1	Programming for ADC
1	Interfacing simple sensors

1	Key board interfacing
1	Stepper Motor interfacing
1	Serial Communication Interface
1	Programming for Transmit and Receive
1	Programming for Transmit and Receive
1	I2C bus interfacing
1	RTC Interfacing
1	External EPROM interfacing
1	GSM Modem interfacing

8. Course Assessment :

Written test (Fill in the blanks and objective type questions) = 25 Marks
Project development (as a team) = 25 Marks
Total = 50 Marks

9. References:

- Reference book is Embedded C Programming and the Microchip PIC by BARNETT.
- Design with PIC microcontrollers by John B.Peatman
- The 8051 Microcontroller and Embedded Systems Using Assembly and C by Mazidi. Pearson Education
- Web Resources/links www.microchip.com/pic
- Web Resources/links www.keil.com/uvision

10. Resource Requirements:

- Systems –PC's required as per the number of students
- Software Tools – Proteus and CCS Compiler

140ER5121 EMBEDDED SYSTEM BASED DESIGN OF POWER ELECTRONIC DRIVES

1. **Title of the Course :** Embedded system based design of power electronic drives
2. **Aim:**

To impart knowledge and provide hands-on experience in

- Fundamentals of hardware design and testing.
- The basics of embedded programming.

3. **Prerequisites:**

- Basics of electronic devices and circuits
- C Programming, Microcontroller.

4. **Course Outcomes:**

At the end of the course, the students will be able to:

- Understand the constraints in embedded software development.
- Understand the interfacing of digital and analog I/O devices.
- Understand hardware design and implementation
- Gain experience in real time hardware projects using simulator softwares.

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	Schematic entry	PPTs, Design entry using PROTEUS tool.
2.	Design - Simulation	PPTs, Schematic design simulation using PROTEUS tool.
3.	PCB layout	PPTs, Layout verification of test circuits using EAGLE tool.

6. **Syllabus:**

Unit-I Introduction **7**

Introduction - Arduino Architecture &arduino IDE- Proteus software- Power electronics- Types of power electronic switches- MOSFET- IGBT- power diode- opto coupler- Driver circuit.

Unit-II Programming with Arduino **8**

Programming on Arduino- Configuring I/O ports- ADC- Timers- PWM pulse generation- Interfacing with hardware.

Unit- III Hardware design **8**

Introduction to hardware design- DC drive- Design of power supply regulator- Design of chopper – Design of gate driver- Isolation circuit- Component selection using datasheet- Simulation using proteus.

Unit- IV PCB Design **8**

Introduction to Eagle software- Schematic design- Layout formation- Etching process- testing of PCB- Components soldering.

Theory: 10 Hrs
Practical: 20Hrs
Total: 36Hrs

7. Course Plan:

S.No	Content to deliver	Hours
1	Introduction - Arduino Architecture &arduino IDE- Power electronics-Switches in power electronics-Opto coupler-Driver-Introduction to PROTEUS	2+ 5
2	Programming on Arduino-Configuring I/O ports-ADC-Timers-PWM pulse generation	3 + 5
3	Introduction to hardware design-DC drive-Design of power supply regulator-Design of chopper-Design of gate driver-Component selection using datasheet	3 + 5
4	Introduction to Eagle software-Schematic design-Layout formation-Etching process-Testing of PCB-Components soldering	3+ 5

8. Course Assessment:

S. No	Description	Max. Marks
1.	Test 1 – Basics design in Power electronic circuits	20
2.	Practical Test 2 – Programming and Simulation for power converter circuits using Proteus and PCB design using Eagle software.	50
3.	Weekly Exercises	30
	Total Marks	100

9. References:

- Beginning Arduino by Michael McRoberts
- Reference book is power electronics by Bimbra.
- www.cadsoftusa.com/training
- www.theengineeringprojects.com
- www.proteme.org

10. Resource Requirements:

Software : Proteus, Arduino IDE, Eagle

140ER5122 INDUSTRIAL AUTOMATION

1.Title of the Course: Industrial Automation

2.Aim:

To impart knowledge in automation technologies used in Process Industries, Automotive Industries, Home, Factory, Agriculture etc.

3. Prerequisites

- Basic knowledge in hydraulics and pneumatics
- Basic knowledge in Analog/Digital circuits and electrical drives
- Principles and operations of sensors and transducers Basic
- knowledge in microprocessor based systems

4. Course Outcomes:

At the end of the course, the student will be able to:

- Understand the basics of hydraulics, electro hydraulics and its circuits
- Understand the basics of pneumatic, electro pneumatics and its circuits
- Develop an automation system with suitable sensors
- Develop PLC software for simple automation applications
- Interface electrical drives and sensors with PLC

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	Hydraulics and Electro Hydraulics	PPTs, Videos and Practices using Hydraulic Instruments
2.	Pneumatics and Electro Pneumatics	PPTs, Videos and Practices using Pneumatic Instruments
4.	Sensorics	PPTs and Practices on different Sensors
5.	PLC	PPTs Practices on Rexroth PLCs

6.	Mechatronics	PPTs, Videos and Practices onBosch Mechatronics System

6. Syllabus:

Unit I HYDRAULICS 6

Basics of Hydraulics - Components of hydraulics - Types of valves – DCVs - operations - hydraulic Circuits – Electro hydraulics - Solenoids - Relays - Electrical logic circuits - Applications of electro hydraulics - Practices on electro hydraulic circuits.

Unit II PNEUMATICS 6

Basics of Pneumatics - Components of Pneumatics - Types of valves - DCVs - operations - Pneumatic circuits – Electro pneumatics - Electrical Logic circuit – Relay ladder logic - Applications of electro pneumatics - Practices on electro pneumatic circuits.

Unit III SENSORICS 5

Introduction to sensorics - Closed loop system - Types of Proximity sensors - construction - principle of operation - Applications proximity sensors - electrical connections - Practices on all types of proximity sensors

Unit IV PLC TECHNOLOGY 10

Introduction to PLC H/W - Architectural evolution - Role of PLC in Automation - Ladder Logic - Basics of digital logic - Latching - Selections of PLC - Practices on Ladder logic using PLC.

Unit V MECHATRONICS 3

Introduction to Mechatronics system – over view of Automation System – Types of Automation– role of sensors in automation system – Electrical drives – interfacing of PLC – Case study of modular Mechatronics System (mMs) – Demonstration of mMs - Troubleshooting of mMs

Theory: 10 Hrs
Practical: 20 Hrs
Total: 30 Hrs

7. Course Plan:

No of Day	No. of Lecture Hrs	Content to Deliver	Remarks
1	2	Basics of Hydraulics, Components and types of valves, Solenoids and relays	PPT (Class Room)

	2	Practices on Hydraulic circuits and Electro Hydraulic circuits	Lab
	2	Practical Test – Hydraulic/Electro Hydraulic circuits	Lab
2	2	Basics of Pneumatics, Components and types of Directional control valves	PPT (Class Room)
	2	Practices on Pneumatic circuits and Electro Pneumatic circuits	Lab
	2	Practical Test – Pneumatic/Electro Pneumatic circuits	Lab
3	2	Concept of control systems and Different types of sensors	PPT (Class Room)
	1	Practices on different types of proximity sensors	Lab
	2	Practical test electrical connection, testing and performance analysis	Lab
4	2	Overview of PLC, H/W structure	PPT (Class Room)
	2	Basic digital logic and relay ladder logic	PPT (Class Room)
	4	PLC Programming – LD and ST	Lab
	1	Test on PLC Programming	Lab

5	2	Overview of Automation systems, role of sensors and electrical drives	PPT (Class Room)
	1	Demo – Mechatronics System	Lab

8. Course Assessment:

S. No	Description	Max. Marks
1.	Practical Test – Hydraulics	20
2.	Practical Test – Pneumatics	20
3.	Practical Test – Sensorics	20
4.	PLC Programming	20
5.	Practical Test – Mechatronics	20
	Total (A)	100/2 = 50
	Aptitude Test(B)	20
	Mini Project (C)	30
	Total Marks (A+B+C)	100

9. References:

- Bosch Rexroth User Manuals
- W. Bolton “Mechatronics” PHI, 2010
- www.boschrexroth.com/en/xc/training/elearning/elearning

10. Resource Requirements:

140ER5123 NEW AND RENEWABLE ENERGY TECHNOLOGIES

1. **Title of the Course :** New and Renewable Energy Technologies

2. **Aim:**
   To impart knowledge in alternatives for fossil fuels, solar power, wind power and other technologies.

3. **Prerequisites:**

   - An idea about Electrical Machines.
   - A basic knowledge in Electronics.

4. **Course Outcome:**
   At the end of the course, the student will be able to:

   - Gain expertise in Renewable Energy Technologies.
   - Understand about Microgrid and Smartgrid.

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	INTRODUCTION	PPTs, Class Room
2.	SOLAR POWER	PPTs, Site Visit, Case Study
3.	WIND POWER	PPTs , Site Visit
4.	OTHER TECHNOLOGIES	PPTs , Site Visit
5.	APPLICATIONS	PPTs, Class Room

6. **Syllabus:**

INTRODUCTION **4**

Fossil fuels - past, present & future - Remedies & alternatives for fossil fuels – Renewable Energy Sources – Global and Indian power scenario - Energy Policy.

SOLAR POWER **7**

Solar PV Power system – PV Cell: Technologies, Module, Array, - IV and PV curves – Design of Array – system components – Overview of solar thermal systems – Operation and maintenance of grid connected solar system – case study.

WIND POWER **7**

Wind power scenario – Speed and power relations – wind resource map - system components – control requirements – Environmental aspects

OTHER TECHNOLOGIES **7**

Biomass plant – Cogeneration plant - Hydrogen Energy - Fuel Cells - Alternative Fuels for Surface Transportation - Geo Thermal Energy - Tidal Energy - Biofuels

APPLICATIONS **5**

Introduction to micro grid and smart grid systems.

Total: 30Hrs

7. Course Content:

S.No.	Content	Hours
1	**INTRODUCTION** Fossil fuels - past, present & future - Remedies & alternatives for fossil fuels – Renewable Energy Sources – Global and Indian power scenario - Energy Policy.	4
2	**SOLAR POWER** Solar PV Power system – PV Cell: Technologies, Module, Array, - IV and PV curves – Design of Array – system components – Overview of solar thermal systems – Operation and maintenance of grid connected solar system – case study.	7
3	**WIND POWER** Wind power scenario – Speed and power relations – wind resource map - system components –	7

	control requirements – Environmental aspects	

4	**OTHER TECHNOLOGIES** Biomass plant – Cogeneration plant - Hydrogen Energy - Fuel Cells - Alternative Fuels for Surface Transportation - Geo Thermal Energy - Tidal Energy – Biofuels	7
5	**APPLICATIONS** Introduction to micro grid and smart grid systems.	5

8. Course Assessment:

S. No	Description	Max. Marks
1.	Case Study	75
2.	Descriptive Type Test	25
	Total	100

9. References:

1. Mukund R. Patel, "Wind and Solar Power Systems – Design, Analysis and Operation", CRC Press, 2006.
2. Chetan Singh Solanki, " Solar Photovoltaics Fundamentals, Technologies and Applications" 2013.
3. Volker Quasching, " Understanding Renewable Energy systems" Jan 2005
4. www.mnre.gov.in
5. http://www.cea.nic.in
6. http://www.cwet.tn.nic.in

10. Resource Requirements:

Projector and Laptop

14ER5116 PC HARDWARE ASSEMBLING TROUBLESHOOTING

1. **Title of the Course:** PC Hardware Assembling & Troubleshooting.

2. **Aim:**

   This course imparts practical knowledge and provides hands-on experience in the area of how to assemble computers, and how to troubleshoot hardware and software issues.

3. **Prerequisites:**

   Basic knowledge of computer peripherals.

4. **Course Outcomes:**

   At the end of this course, the students will be able to

   - Explain, install, and navigate an operating system, upgrade components based on customer needs and perform preventive measures and trouble shooting.
   - Assess customer needs, analyze possible configurations, and provide solutions or recommendations for hardware, operating systems, networking and security.

5. **Teaching Strategies:**

   - Group activities
   - Power point presentations and Video Presentations
   - Practical demonstrations

6. **Syllabus:**

Module I PC Hardware 6

BIOS settings-Motherboard Components– RAM– Expansion Cards– Storage Devices– The CPU– Interfaces– Computer Power– Custom Computer Components– Display Devices– Connector Types– Computer Peripherals

Module II Networking 6

Network Connectors– Network Cabling– TCP/IP– Common Network Ports– Wireless Networking Standards– Installing a Wireless Router– Internet Connection Types– Network Types– Common Network Devices– Networking Tools

Module III Operating Systems 6

Microsoft Operating Systems– Installing Windows– The Windows Command Line– Operating System Tools– The Windows Control Panel– Configuring Windows Networking– Windows Preventive Maintenance– Windows Security– Client-Side Virtualization

Module IV Laptops, Printers and Mobile Devices **6**

Laptop – Hardware, Displays; Printers-Installing and maintenance; Mobile devices- Mobile Operating Systems-– Network Connectivity -Securing Mobile Devices-Mobile Device Synchronization

Module V Assembling and Troubleshooting **6**

Hardware assembling- Common Hardware Problems– Troubleshooting techniques of Devices- Hard Drive, Networks, Operating System, Laptops and Troubleshooting Printers.

Theory : 10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan:

S. No	Topic	Period (Hrs)
Module I:	**PC Hardware**	
1.	BIOS settings-Motherboard Components– RAM– Expansion Cards Storage Devices–The CPU– Interfaces	1
2.	Computer Power– Custom Computer Components– Connector Types– Computer Peripherals	1
3.	Practical session on Assembling and verifying PC hardware	4
Module II:	**Networking**	
4.	Network Connectors– Network Cabling– TCP/IP– Common Network Ports Wireless Networking Standards– Installing a Wireless Router– Internet Connection Types	1
5.	Network Types– Common Network Devices– Networking Tools	1
6.	Practical session on installation of LAN and internet connection	4
Module III:	**Operating Systems**	

7.	Microsoft Operating Systems– Installing Windows– The Windows Command LineOperating System Tools– The Windows Control Panel– Configuring Windows Networking	1
8.	Windows Preventive Maintenance– Windows Security– Client-Side Virtualization	1
	Practical session on installation of OS	4
Module IV:	**Laptops, Printers and Mobile Devices**	
10.	Laptop – Hardware, Displays; Printers-Installing and maintenance Mobile devices- Mobile Operating Systems-– Network Connectivity	1
11.	Securing Mobile Devices-Mobile Device Synchronization	1
12.	Practical session on Peripheral interfacing	4
Module V:	**Assembling and Troubleshooting**	
13.	Hardware assembling- Common Hardware Problems Troubleshooting techniques of devices- Hard Drive, Networks	1
14.	Networks, Operating System, Laptops and TroubleshootingPrinter	1
15.	Practical session on Hardware assembling and Trouble shooting	4

8. Course Assessment :

S.No.	Description	Marks
1	**Assessment -1** • Presentation • Quiz	20
2	**Assessment -2** Practical Exam	30
3	**Total**	**50**

9. References:

- Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, James. K.L, PHI Publications.
- Troubleshooting your PC for dummies, Dan Gookin, Wiley Publishing Inc.
- Upgrading and Repairing PC's, Scott Muller
- http://www.professormesser.com/free-a-plus-training/free-a-plus/

10. Resource Requirements:

Personal Computers, Laptops, projector, mobile phones and printer

140ER5124 PCB DESIGNING USING PCB EXPRESS

1. **Title of the Course :**PCB designing using PCB Express

2. **Aim:**

This course imparts theoretical and practical knowledgeon the techniques for the design and production of PCBs.

3. **Prerequisites:**

- Basics of symbolic representation electrical elements and circuits

4. **Learning Goals/Outcomes:**

At the end of the course, the students will be able to:

- Understand different tools used for PCB designing.
- Do projects in PCB design,
- Tackle the Placing, Routing and editing problems
- Understand the Print-out methods involved in PCB design

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	PCB design Concepts	PPTs and Videos
2.	PCB design Examples and Exercises	Practical's

6. **Syllabus:**

UNIT 1

Different tools used for PCB designing, PCB design Software, Getting started with Tools, Starting a project, Setting up your project, Placing, editing, and connecting parts and electrical symbols, Adding and editing graphics and text, Changing your view of a schematic page, About libraries and parts, Creating and editing parts.

UNIT 2

Processing tools, Creating a net list Creating reports, Exporting and importing schematic data, PCB DESIGN, PCB Workflow, Foot print generation, Importing, Parts placement Mechanically defined components. Routing guidelines setting, PCB

Construction (Power and Ground Plane), Routing guidelines, Routing Copper Pour, DRCChecking.

UNIT 3

PCB Making practical's, Print-out methods, Gerber file finalizing, Film/Gerber making, Copper plate handling, Printing, Cutting, Rubbing methods, Green masking, Compo masking, Tinning, Final PCB testing. Soldering Techniques, how to solder different components, Safety Precautions.

THEORY: 10 Hrs

PRACTICAL: 20 Hrs

TOATL : 30 Hrs

7. Course Plan:

S.No.	Topic	Hours
1	Different tools used for PCB designing	2hrs
2	Getting started with Tools, Starting a project, Placing, editing, and connecting parts and electrical symbols,	5hrs
3	Adding and editing graphics and text, Changing your view of a schematic page,	2 hrs
4	About libraries and parts, Creating and editing parts.	2 hrs
5	Processing tools, Creating a net list Creating reports, Exporting and importing schematic data, PCB DESIGN, PCB Workflow	5 hrs
6	Footprint generation, Importing, Parts placement Mechanically defined components. Routing guidelines setting, PCB Construction (Power and Ground Plane), Routing guidelines, Routing Copper Pour, DRC Checking.	2 hrs
7	Making practical's, Print-out methods, Gerber file finalizing, Film/Gerber making.	2 hrs
8	Copper plate handling, Printing, Cutting, Rubbing methods,	2 hrs
9	Green masking, Compo masking, Tinning,	2 hrs
10	Final PCB testing and Soldering Techniques	3 hrs

11	How to solder different components and Safety Precautions	3 hrs

8. Course Assessment:

S. No	Description	Max. Marks
1.	PCB design Assignments	50
2.	Practical Test at the end of the Course	50
	Total Marks	**100**

9. References :

1. Printed circuit Board, Christopher T.Robertson, Publishing as Prentice Hall Professional Technical Reference, 2004.
2. Ebook.Coombs, Printed circuit hand book, McGraw Hill, fifth edition.
3. Ebook.EMC and Printed circuit Board, Mark I. Montrose.

10. Resource Requirements:

Virtual Instrumentation Lab with PCB Software

140ER5125 PROJECT DEVELOPMENT USING 'C'

1. **Title of the Course:** Project Development using 'C'
2. **Aim:**
   - To learn the basics of 'C' Programming and understand the usage of Arrays, Pointers and Structures in real time programming applications.

3. **Prerequisites :**
   Programming Knowledge

4. **Course Outcomes:**
   At the end of the course, the students will be able to:
   - Write a 'C' program for arithmetic, Logical and looping operations.
   - Create Functions in 'C' program.
   - Distinguish and create Array/ Structures/ Pointers in 'C'.
   - Develop / Create 'C' programs for applications.

5. **Teaching Strategies:**
   - ❖ Peer Teaching
   - ❖ Lab work
   - ❖ Simulation

6. **Syllabus:**
   - ❖ Introduction to 'C'
   - ❖ Control Statements
   - ❖ Arrays and Strings
   - ❖ Functions
   - ❖ Structures
   - ❖ File Handling
   - ❖ Projects using 'C'

Theory :10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Content:

Lab/ Peer work	Topic
Lab class: 1 Duration: 3Hours	Introduction to Programming and Programming Languages ***Structure of a 'C' program*** *(Questionnaire to identify students proficiency in C Programming)*
Lab class: 2 Duration: 3Hours	❖ ***Peer Teaching on Control Statements and its types***– Sequential, Selection , Iteration, Jump and Function call Simple programs related to control statements Assignment Programs: 1. Program to accept a character and check if it is vowel or not. 2. Program to find Factorial of a number 3. Program to find Fibonacci and LCM, GCD of 2 numbers, etc…
Lab class: 3 Duration: 3Hours	❖ ***Peer Teaching on Arrays and strings:*** Practicing of simple programs related to arrays and strings.
Lab class: 4 Duration: 3Hours	Exercises Related to *Arrays and strings:* 1. Program to accept 10 integers in an array and find the sum of all elements 2. Program to add two strings without using string functions 3. Program to perform multiplication of two matrices
Lab class: 5 Duration: 3Hours	❖ ***Peer Teaching on Functions, Types and Characteristics:*** Simple programs to create Functions
Lab class: 6 Duration: 3Hours	Exercises Related to *Functions:* 1. Program to create a function area () which takes radius and returns area of circle. Also to fine area of circle using it. 2. Program to define a function factorial () which returns a factorial of a number and to find Permutation and Combinations using the same.
Lab class: 7 Duration: 3Hours	❖ ***Peer Teaching on Structures :*** Simple programs related to Structures
Lab class: 8	Sample Exercises Related to *Structures:*

Duration: 3Hours	1. Program to create a structure player having members name, country name and match fee.

Lab class: 9 Duration: 3Hours	❖ ***Peer Teaching on <u>File Handling</u>*** Simple programs related to file handling
Lab class: 10 Duration: 3Hours	<u>Sample Exercises Related to File Handling:</u> 1. Program to copy one file to another by converting all characters to uppercase.

8. Course Assessment:

- Regular Laboratory Exercises: 50
- End Test : 50
- Total : 100

Project Titles:

1. Employee Record System Project using 'C'
2. Student Record System Project using 'C'
3. Employee Database Project using 'C'
4. Cafeteria ordering system using 'C'
5. Household Budget Management System using 'C'
6. Online Movie Ticket Booking system using 'C'

9. References:

- "Byron Gottfried, "Schaum's Outline of programming with C", 2nd Edition, (Indian Adapted Edition), TMH Publications, New Delhi, 2006.
- Programming Projects in 'C' for students of Engineering, science and Mathematics by RoubenRostamanian, October 2014.
- 'C' Programming a modern approach by K.N.King
- The C Programming Language by Brian W. Kernighan, Dennis M. Ritchie
- The C Library Reference guide by Eric Huss

10. Resource Requirements:

- Systems –PC's required as per the number of students
- Software Tools – Turbo 'C'

140ER5126 SPEECH AND AUDIO SIGNAL PROCESSING USING MATLAB

1. **Title of the Course:** Speech and Audio Signal Processing using MATLAB
2. **Aim:**

   This course is intended for providing an insight into the nature of speech and audio signals, exploring the different parameters associated with short-time analysis of speech signals and learning the effects of filtering audio signals.

3. **Prerequisites:**

   The student must have knowledge on
   - Basics of signals
   - Basics of MATLAB
   - Knowledge on filters may be preferable

4. **Course Outcomes:**

   At the end of this course, students will be able to:
   - Understand the need for all the basic preprocessing tasks associated with speech signals and perform the same efficiently.
   - Extract various parameters related to speech signals
   - Understand filtering concepts and companding techniques
5. **Teaching Strategies:**
   - Power point presentations
   - Practical demonstrations
   - Programming and simulation

6. **Syllabus:**

   Module I: 10

   Introduction to MATLAB, Introduction to signals- stationary and non-stationary signals, Introduction to speech signals-speech production mechanism-import and export speech signals- sampling frequency-short-time analysis- framing and windowing.

   Module II: 12

Short-time parameters- short-time energy- zero crossing rate- short-time auto correlation, silence removal using short-time parameters, noise removal.

Module III: 8

Effect of filtering audio signals, Companding techniques- A-law and μ-law companding.

Theory :10 Hrs
Practical : 20 Hrs
Total : 30 Hrs

7. Course Plan:

S.No	Topic	Period
	Module I	
1.	Introduction to MATLAB, Introduction to signals	3
2.	Stationary and non-stationary signals	1
3.	Introduction to speech signals-speech production mechanism	2
4.	Import and export speech signals- sampling frequency	1
5.	Short-time analysis- framing and windowing.	3
	Module II	
6.	Short-time parameters- short-time energy	2
7.	Zero crossing rate	2
8.	Short-time auto correlation	2
9.	Silence removal using short-time parameters	3
10.	Noise removal	3
	Module III	
11.	Effect of filtering audio signals	3
12.	Companding techniques- A-law companding	3
13.	μ-law companding	2

8. Course Assessment :

S. No	Description	Max. Marks
1.	**Assessment-I** Course Report	20
2.	**Assessment-II** Design Test	30

TOTAL	50

9. References:

- Introduction to Digital Speech Processing, Lawrence R. Rabiner, Ronald W. Schafer
- Digital Processing of Speech Signals, Lawrence R. Rabiner
- http://iitg.vlab.co.in/?sub=59&brch=164

10. Resource Requirements:

Equipments required: Personal Computers, projector, headphones
Software Required- MATLAB, Gol

11ER020 AUTOMOTIVE ELECTRICAL AND ELECTRONICS

1. **Title of the Course:** Automotive Electrical and Electronics
2. **Aim:**

   To impart knowledge of Automotive Electronics and control systems
3. **Prerequisites:**

   The students must have basic knowledge in Electrical and Electronic devices and circuits.
4. **Course Outcomes:**

   At the end of the course students will be able to
   - Explain the Automobile Electrical and Electronics systems
   - Diagnose fault in a given automotive electrical system

5. **Teaching Strategies:**
   - Lecture
   - Power point presentation
   - Tutorials

6. **Syllabus:**
   - Chassis electronics
   - Body electronics
   - Sensors
   - Communication protocol
   - Ignition systems

   Total Hours: 30
7. **Course Plan**
   - **Chassis electronics**
     - ABS
     - ESP
     - ASR/TCS
   - **Body electronics,**
     - Door control module
     - Lighting system
   - **Sensors,**
     - Hall sensor
     - Inductive sensor
     - Knock sensor
     - Temperature sensor

- **communication protocol**
  - CAN
  - LIN

- **Ignition systems**
  - Electronic ignition system
  - Transistor ignition system

8. Course Assessment :

S. No	Description	Max. Marks
1.	Continuous Assessment (Quiz/Assignment)	30
2.	Continuous Assessment (Case Study)	30
3.	Final Assessment (Test)	40
	Total Marks	100

9. References:

- www.microchip.com
- www.frescale.com
- Automotive electrical and electronics by TOM DENTON 4th edition, B&H Publishing Company.

10. Resource Requirements:

Automotive electronics kits LUCAS NULLE and LABSOFT software available at MCET TUV Automotive Training Centre.

140ER5120 EMBEDDED PROGRAMMING USING PIC MICROCONTROLLERS

11. Title of the Course : Embedded Programming using PIC Microcontrollers

12. Aim:

This course will familiarize the student with the basic principles and techniques of embedded programming using PIC microcontroller and CCS Compiler.

13. Prerequisites:

- Basics of Electronics Circuits
- Microprocessor and Microcontroller
- Basics of C Programming.

14. Course Outcomes:

At the end of the course, the student will be able to:

- Gain experience inworking in real time embedded system projects, and cooperating on various aspects of project development in a team.
- Understand the interfacing of digital and analog I/O devices.
- Understand modular multitasking embedded programming

15. Teaching Strategies:

- ❖ Simulation and Demonstration
- ❖ Power point presentation
- ❖ Chalk and talk

16. Syllabus:

Unit I **9**

Introduction to Microcontrollers - Microcontroller PIC16F877A architecture - Introduction to PIC CCS Compilers - Introduction to PROTEUS - Introduction to I/O ports - Programming using I/O ports

Unit II **12**

LCD interfacing 7 Segment Display - Introduction to Timers/Counters - Programming using Timers/Counters - Programming using Timer0 - PWM Pulse Generation - Programming using

PWM - DC Motor control - Analog to Digital I/O - Programming for ADC - Interfacing simple sensors

Unit III **9**

Key board interfacing - Stepper Motor interfacing - Serial Communication Interface – Programming for Transmit and Receive - Programming for Transmit and Receive - I2C bus interfacing - RTC Interfacing - External EPROM interfacing - GSM Modem interfacing

Theory: 12Hrs
Practical: 18 Hrs
Total: 30 Hrs

17. Course Plan:

Hours	Topic
1	Introduction to Microcontrollers
1	Microcontroller PIC16F877A architecture
1	
1	Introduction to PIC CCS Compilers
1	Introduction to PIC CCS Compilers
1	Introduction to PROTEUS
1	Introduction to I/O ports
1	Programming using I/O ports
1	Programming using I/O ports
1	LCD interfacing/7 Segment Display
1	
1	
1	Introduction to Timers/Counters
1	Programming using Timers/Counters
1	Programming using Timer0
1	PWM Pulse Generation
1	Programming using PWM

1	DC Motor control
1	Analog to Digital I/O
1	Programming for ADC
1	Interfacing simple sensors
1	Key board interfacing
1	Stepper Motor interfacing
1	Serial Communication Interface
1	Programming for Transmit and Receive
1	Programming for Transmit and Receive
1	I2C bus interfacing
1	RTC Interfacing
1	External EPROM interfacing
1	GSM Modem interfacing

18. Course Assessment :

Written test (Fill in the blanks and objective type questions) = 25 Marks
Project development (as a team) = 25 Marks
Total = 50 Marks

19. References:

- Reference book is Embedded C Programming and the Microchip PIC by BARNETT.
- Design with PIC microcontrollers by John B.Peatman
- The 8051 Microcontroller and Embedded Systems Using Assembly and C by Mazidi. Pearson Education
- Web Resources/links www.microchip.com/pic
- Web Resources/links www.keil.com/uvision

20. Resource Requirements:

- Systems –PC's required as per the number of students

- Software Tools – Proteus and CCS Compiler

11ER017 INDUSTRIAL AUTOMATION

1. Title of the Course: Industrial Automation

2. Aim:

To impart knowledge in automation technologies used in Process Industries, Automotive Industries, Home, Factory, Agriculture etc.

3. Prerequisites:

- Basic knowledge in hydraulics and pneumatics
- Basic knowledge in Analog/Digital circuits and electrical drives
- Principles and operations of sensors and transducers Basic
- knowledge in microprocessor based systems

4. Course Outcomes:

At the end of the course, the student will be able to:

- Understand the basics of hydraulics, electro hydraulics and its circuits
- Understand the basics of pneumatic, electro pneumatics and its circuits
- Develop an automation system with suitable sensors
- Develop PLC software for simple automation applications
- Interface electrical drives and sensors with PLC

5. Teaching Strategies:

S.No.	Description	Teaching Methods
1.	Hydraulics and Electro Hydraulics	PPTs, Videos and Practices using Hydraulic Instruments
2.	Pneumatics and Electro Pneumatics	PPTs, Videos and Practices using Pneumatic Instruments
4.	Sensorics	PPTs and Practices on different Sensors
5.	PLC	PPTs Practices on Rexroth PLCs
6.	Mechatronics	PPTs, Videos and Practices on

		Bosch Mechatronics System

6. Syllabus:

Unit I HYDRAULICS 6

Basics of Hydraulics - Components of hydraulics - Types of valves – DCVs - operations - hydraulic Circuits – Electro hydraulics - Solenoids - Relays - Electrical logic circuits - Applications of electro hydraulics - Practices on electro hydraulic circuits.

Unit II PNEUMATICS 6

Basics of Pneumatics - Components of Pneumatics - Types of valves - DCVs - operations - Pneumatic circuits – Electro pneumatics - Electrical Logic circuit – Relay ladder logic - Applications of electro pneumatics - Practices on electro pneumatic circuits.

Unit III SENSORICS 5

Introduction to sensorics - Closed loop system - Types of Proximity sensors - construction - principle of operation - Applications proximity sensors - electrical connections - Practices on all types of proximity sensors

Unit IV PLC TECHNOLOGY 10

Introduction to PLC H/W - Architectural evolution - Role of PLC in Automation - Ladder Logic - Basics of digital logic - Latching - Selections of PLC - Practices on Ladder logic using PLC.

Unit V MECHATRONICS 3

Introduction to Mechatronics system – over view of Automation System – Types of Automation– role of sensors in automation system – Electrical drives – interfacing of PLC – Case study of modular Mechatronics System (mMs) – Demonstration of mMs - Troubleshooting of mMs

Theory: 10 Hrs
Practical: 20 Hrs
Total: 30 Hrs

7. Course Plan:

S. No.	Hours	Content to Deliver	Remarks
1	2	Basics of Hydraulics, Components and types of valves, Solenoids and relays	PPT (Class Room)
	2	Practices on Hydraulic circuits and Electro Hydraulic circuits	Lab
	2	Practical Test – Hydraulic/Electro	Lab

		Hydraulic circuits	
2	2	Basics of Pneumatics, Components and types of Directional control valves	PPT (Class Room)
	2	Practices on Pneumatic circuits and Electro Pneumatic circuits	Lab
	2	Practical Test – Pneumatic/Electro Pneumatic circuits	Lab
3	2	Concept of control systems and Different types of sensors	PPT (Class Room)
	1	Practices on different types of proximity sensors	Lab
	2	Practical test electrical connection, testing and performance analysis	Lab
4	2	Overview of PLC, H/W structure	PPT (Class Room)
	2	Basic digital logic and relay ladder logic	PPT (Class Room)
	4	PLC Programming – LD and ST	Lab
	1	Test on PLC Programming	Lab
5	2	Overview of Automation systems, role of sensors and electrical drives	PPT (Class Room)
	1	Demo – Mechatronics System	Lab

8.Course Assessment:

S. No	Description	Max. Marks
1.	Practical Test – Hydraulics	20
2.	Practical Test – Pneumatics	20
3.	Practical Test – Sensorics	20
4.	PLC Programming	20
5.	Practical Test – Mechatronics	20
	Total (A)	100/2 = 50
	Aptitude Test(B)	20
	Mini Project (C)	30
	Total Marks (A+B+C)	100

9. References:

- Bosch Rexroth User Manuals
- W. Bolton "Mechatronics" PHI, 2010
- www.boschrexroth.com/en/xc/training/elearning/elearning

10. Resource Requirements:

MCET-Bosch Rexroth Centre of Competence

11ER021 INSTRUMENTATION SYSTEM DESIGN

1.Title of the Course : Instrumentation System Design

2. Aim:

To impartpractical knowledge in instrumentation systems, process control elements and process automation technologies used in Process Industries .

3. **Prerequisites:**

- Basic knowledge in Analog/Digital circuits and electrical drives
- Principles and operations of sensors and solenoids
- Basic knowledge in microcontroller and PLC
- Software knowledge – Embedded C, Ladder logic and LabVIEW\

4. Learning Goals/Outcomes:

At the end of this course, the student will able to:

- Gain expertise on instrumentation systems and process control elements
- Develope process automation system with suitable sensors
- Interface electrical/pneumatic drives with control systems
- Understand the Safety and security in Process Industries

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	Process Control and Safety	PPTs and Videos
2.	Signal conditioning circuits	Chalk and Practices in Design Project Lab
3.	Control Elements	Chalk and Practices in Process Project Lab
4.	Controller design	DP Lab, VI Lab and PC Lab

6. Syllabus:

UNIT I PROCESS CONTROL AND PROCESS SAFETY ELEMENTS 4

Overview of Process control - Identification of elements, Control loop, Control System evaluation. P and I Symbols and diagrams – Process Safety Incidents – Process Involvement – Reporting Thresholds – Location – Actual release – Industry Process Safety Metrics.

UNIT II ANALOG/DIGITAL SIGNAL CONDITIONING 8

Overview of OPAMP: Differential Instrumentation Amplifier – (4-20) ma Current converter – Signal Conditioning for temperature sensors, Position sensor, Strain Sensor and Photo detectors. V/F converter, ADC and DAC

UNIT III CONTROL ELEMENTS 8

Current to Pressure Converter – Switching devices - electrical control solenoid valves, Relays – Hydraulic / Pneumatic Actuators - Fluid Valves – Pneumatic valve - Director control valve – 3/2 way valve – 5/2 way valve – Shuttle valve – check valve.

UNIT IV INTERFACING WITH CONTROLLERS 10

Microcontroller: LCD interfacing – Displaying temperature sensors, Position sensor, Strain Sensor and status on LCD – Speed Measurement. LabVIEW based Measurement and Control. PLC based Measurement and control.

Theory: 10Hrs
Practical: 20 Hrs
Total: 30 Hrs

7. Course Plan:

S. No	Content to Deliver	Hours	Remarks
1	Overview of Process control & Components	1	PPT (Class Room) Lab
2	P and I Diagrams	1	
3	Process Safety elements	1	
4	Overview of OPAMP	1	
5	Signal Conditioning – Different Sensors	4	Design Project Lab
6	ADC/DAC and V-F Circuits	4	
7	Control Elements – Pneumatic Valves	2	Process Control Lab
8	DCV – Different types	6	

9	Microcontroller based system design	3	DP Lab
10	PLC/LabVIEW based System Design	3	PC/VI Lab
11	Mini Project	4	Lab

8. Course Assessment:

S. No	Description	Max. Marks
1.	Process Control and Safety - Test	25
2.	Practical Test – Signal Conditioning Circuits	25
3.	Practical Test – Microcontroller based System Development	25
4.	Practical Test – LabVIEW/ PLC based System Development	25
	Practical Marks Total (A)	100/2 = 50
	Aptitude Test(B)	20
	Mini Project (C)	30
	Total Marks (A+B+C)	**100**

9. References:

1. Curtis D. Johnson, "Process Control Instrumentation Technology", PHI Learning PVT Ltd., New Delhi, 2012.
2. D. Patranabis, "Instrumentation and Control", PHI Learning PVT Ltd., New Delhi, 2011.
3. www.pacontrol.com

10.Resource Requirements:

1. Design Project Lab

2. Virtual Instrumentation Lab
3. Process Control Lab

11ER018 INTRODUCTION TO INDUSTRIAL ELECTRICAL SYSTEM

1.Title of the Course: Introduction to Industrial Electrical System

2. Aim:

To bring the awareness in the students regarding latest trends in electrical industry in the field of switchgears & protection and provide them with hands-on experience

3. Prerequisites:

Knowledge of basic concepts of electrical engineering

4. Corse Outcomes:

At the end of the course, the students will able to:

- Acquire good knowledge & overview of latest switchgears products
- Gain knowledge on the protective systems which is prevalent in the modern industry.

5. Teaching Strategies:

S.No	Description	Teaching Methods
1.	a. Electrical Safety, b. LV Switchgear c. Various examples of LV switchgear d. Motor starters e. Electrical Protection systems f. Different unit Protection	PPTs, Discussions & Explanation during class room sessions, co-relation with latest trends in modern industry
2.	a. Various LV switchgear b. Motor starters c. Protection Relays	Hands on experience in the lab, various experiments, testing, demonstration etc.

6.Syllabus:

Unit I 20

Importance & Selection of LV switchgear - Electrical safety, various LV switchgear their importance, operation, selections, applications, features, maintenance etc.Workshop session, Hands on practice, Demonstration on above

Unit II 10

Electrical Protection Systems - Concepts of electrical protection system, Overview of Advance Electrical Protection System, various components of protection systems, Feeder Protection Relays, Motor Protection Relays, Workshop session, Hands on practice, Demonstration on above relays

Total: 30 Hrs

7. Course Plan:

S.No.	Content	Hours
1.	Importance of Electrical Safety,	1
2.	Overview of Power Generation, Transmission & Distribution in India	1
3.	Industrial Power Distribution System	1
4.	Study of LV Switchgear: AC Contactors	1
5	Study of LV Switchgear: AC Contactors	1
6.	Study of Overload Relays	1
7.	Motor Starting Techniques	1
8.	Motor Starters	2
9.	Study of Overload Relays	1
10.	Motor Starting Techniques	1
11.	Study of LV Switchgear: HRC Fuses	1
12.	Study of LV Switchgear: Switch Fuse Unit	1

13.	Study of LV Switchgear: MCCB	1
14.	Study of LV Switchgear: ACB	1
15.	Hands on session : Study of LV Switchgear: HRC Fuses	2
16.	Hands on session : Study of LV Switchgear: Switch Fuse Unit	2
17.	Hands on session : Study of LV Switchgear: MCCB	2
18.	Hands on session : Study of LV Switchgear: ACB	2
19.	Concepts of electrical protection system,	1
20.	Overview of Advance Electrical Protection System,	1
21.	various components of protection systems	1
22.	Feeder Protection Relays	1
23.	Motor Protection Relays	1
24.	Feeder Protection Relays	1
25.	Motor Protection Relays	1

8. Course Assessment :

S. No	Description	Max. Marks
1.	Post Course Test	50
	Total	50

9. References:

Study material from L&T Switchgear Training Centre

10. Resource Requirements:

Laboratory equipped with necessary switchgear, test jigs, meters & equipments.

11ER022 MOBILE APPLICATION DEVELOPMENT

1. **Title of the Course:** Mobile Application Development

2. **Aim :**

To impart knowledge about developing the interactive apps for windows mobile environment.

3. **Prerequisites:**

- Basic programming knowledge in C++ and C#

4. **Course Outcomes:**

At the end of the course, the students will be able to,

Design a mobile application

Create a web application along with multimedia effects

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	Introduction and Programming in C#	PPTs, and simple programs
2.	Designing using XAML	PPTs, Videos and Programming
3.	Windows 8 App Development Using Templates	Videos and designing
4.	Implementing in Windows Store	Videos and demonstration

6. **Syllabus:**

Unit I Introduction and Programming in C# 10Hrs

Introduction- Windows 8 Installation- Visual Studio Installation- Windows 8 App Lifecycle- Programming in C# - Classes and Methods- Constructors- Access Specifiers- Namespaces- Exception Handling

Unit II XAML 10Hrs

XAML Basics – Adding Controls- Properties- Events- Layouts- Message Dialogue- Designing using C# with XAML

Unit III App Development **10Hrs**

Templates- Grid App- Split App- Web View- User Control- Settings Panel- Navigation- App Bar- Project Solution – Packages- Creating App Package- Publishing App.

7. Course Plan

No. of Hrs	Topic	Remarks
2	Introduction- Windows 8 Installation- V.S installation- Windows 8 App Lifecycle	PPT
2	Programming in C# - Classes and Methods	PPT & Lab
2	Controlling Programmatic Flow; Manipulating Types and Strings	PPT & Lab
2	Constructors- Access Specifiers	PPT & Lab
2	Namespaces- Exception Handling	PPT & Lab
2	XAML Basics	PPT & Lab
2	Adding Controls- Properties	PPT & Lab
2	Layouts	PPT & Lab
2	Events	PPT & Lab
2	Message Dialogue- Designing using C# with XAML	PPT & Lab
2	Templates- Grid App	PPT & Lab
3	Split App- Web View- User Control	PPT & Lab
2	Settings Panel- Navigation- App Bar- project	PPT & Lab
3	Project Solution – Package .appxmanifest- Creating App Package- Publishing App	PPT & Lab

8. Course Assessment

S. No	Description	Max. Marks
1.	Sample App development	50
2.	Assignment on controls in XAML	
3.	Mini Project	50
	Total (A)	100

9. References:

1. http://www.tutorialspoint.com/csharp/csharp_quick_guide.htm
2. Adam Nathan, "Windows Presentation Foundation-Unleased", XAML Developer Reference –O'Reilly Media.
3. http://msdn.microsoft.com/en-us/library/windows/apps

10. Resource Requirements

- Windows 8.1, Visual Studio 2013

11ER023 PROGRAMMING WITH PLC AND HMI

1. **Course Title:**Programming with PLC and HMI
2. **Aim:**

   To impart knowledge to develop PLC based projects, automation systems and HMI based operator interfaces using TIA V11.
3. **Prerequisites:**

   Knowledge in digital logic circuits and relays

4. **Course outcomes:**

   At the end of the course, the students will be able to:

   - Understand relay logic and function of PLC
   - Understand PLC instructions
   - Design PLC based automation systems
   - Create applications that use PLC and HMI

5. **Teaching Strategies:**

S.No	Description	Teaching Methods
1.	Basic concepts of PLC programming	PPTs and Videos
2.	AB, Siemens 1200 PLC and Siemens HMI programming.	Practical's

6. **Syllabus:**

   Unit - 1: Introduction **2**

   Concept of relays, contactors and relay logic

   Unit – 2: Programmable Logic Circuit **8**

   PLC architecture- I/O modules- Basic PLC programming instructions- Concept of inter locks and sequential logic.

Unit – 3: Programming using S7-1214C PLC **2**

Siemens S7-1214C PLC configuration and programming using TIA V11.

Simple programs using Siemens S7-1214C PLC.

Unit - 4: Applications of PLC **10**

Timer and counter instructions. Math and program control instructions.

Real time application based programs using S7-1200

Unit – 5: Human Machine Interface **8**

Introduction to HMI - Integration PLC and HMI - HMI programming

Theory: 10 Hrs
PracticaL: 20 Hrs
Toatl: 30 Hrs

7. Course Plan:

S. No	Topic	Unit	No. of Hours
1	Concept of relays, contactors and relay logic	I	2
2	PLC architecture and I/O modules	II	2
3	Basic PLC programming instructions. Procedure for configuration and programming Siemens S7-1214C PLC.		4
4	Concept of inter locks and sequential logic.		2
5	Siemens S7-1214C PLC configuration and programming using TIA V11. Simple programs using Siemens S7-1214C PLC.	III	2
5	Timer and counter instructions.	IV	3
6	Math and program control instructions. Real time application based programs using S7-1200		3
7	Analog I/O and PID block		4
8	Introduction to HMI	V	2
9	Procedure for Integration PLC and HMI		3
10	HMI programming		3

8. Course Assessment:

S. No.	Description	Marks
1.	Programming Assignments	50
2.	Practical Test at the end of the Course	50
	Total	**100**

9. References:

1. Frank D.Petruzella, 'Programmable Logic Controllers', Fourth edition, Tata McGraw Hill, 2010
2. John W. Webb, Ronald A. Reis 'Programmable Logic Controllers and Applications', PHI Learning,Fifth Edition, 2009
3. http://www.plctalk.com

10. Resource Requirements:

Virtual Instrumentation Lab, Industrial Automation Lab withSiemens S7-1214C PLC

11ER024 RF CIRCUIT DESIGN USING ADS

1.Title of the Course: RF circuit design using ADS

2. **Aim :**
   This course imparts practical knowledge and provides hands-on experience in the area of RF circuit design.

3.Prerequisites:

The student must have knowledge on

i)Electromagnetic Fields
ii) Transmission lines
iii) EM waves and waveguides
iv)Antenna theory

4.Course Outcomes:

At the end of this course, the students will be able to:

- Understand basic RF circuit designs
- Use new simulation tools for RF design
- Acquire practical knowledge in RF field

5. **Teaching Strategies:**
   The teaching methodology include lecture with presentations following with simulation of the design theoretically studied.

6.Syllabus:

Module I: **9**

RF basics, S- parameters and Smith chart, Introduction to simulation tools and ADS, Types of transmission lines and its applications.

Module II: **9**

Antenna Basics, types of antenna and applications, antenna design, feeding techniques, broadband matching, multi band antennas, testing of antenna.

Module III: **9**

Power dividers, Couplers, types and design. Filters, types and applications, design.

Module IV: **3**

Measurement of RF devices, signal with network analyzer, spectrum analyzer, power meter,Anechoic chamber, EMI/ EMC chamber.

Theory : 10 Hrs

Practical : 20 Hrs
Total : 30 Hrs

7.Course Plan:

S. No.	Topic	Hours
Module I		
1.	RF basics	1
2.	S parameters- Smith chart	2
3.	Introduction to Simulation tools and ADS	1
4.	Transmission lines , types and applications	1
5.	ADS demonstration and hands on	2
6.	Lab	2
Module II		
7.	Antenna Basics	1
8.	Types of antenna, Applications	1
9.	Design of Antenna using ADS	1
10.	Lab	1
11.	Feeding techniques, Broadband antennas	2
12.	Multiband Antennas	1
13.	Simulation	2
Module III		
14.	Power dividers, design and simulation	3
15.	Coupler , Design and simulation	3
16.	Filter, design and Simulation	3
Module IV		
17	Measurement with Network analyzer, Spectrum analyzer	2
18	Anechoic chamber, EMI/ EMC chamber	1

8.Course Assessment:

S. No.	**Description**	**Marks**
1	Objective type questions	10
2	Laboratory experiments	20
3	Project design	20
4	Total	50

9.References:

1. Practical RF Circuit design for model wireless systems, Volume –I, Passive circuits and systems, Les Besser and Rowan Gilmore, Artech house publications.
2. Microwave and RF Design of Wireless Systems, David.M.Pozar, John Wiley and sons.
3. Broadband Microstrip Antennas, Girishkumar and K.P.Ray, Artech house Publications.
4. Planar Antennas for Wireless Communication, Kin-Lu-Wong, Wiley Interscience

10.Resource Requirements:

- Equipments required: Personal Computers, projector, Network Analyzer, Spectrum Analyzer, Mixed Signal Oscilloscope, and Signal Generator.

Software Required- Agilent ADS