

**M.Tech**  
**ELECTRONICS DESIGN AND TECHNOLOGY**  
**Syllabus**

## SEMESTER I

SL No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	M101	Industrial Design of Electronic Equipment	3	0	2	4
2.	M102	Microcomputer System Design	3	0	2	4
3.	M103	Analog & Digital Systems	3	0	2	4
4.		Elective - 1	3	0	2	4
5.		Elective - 2	3	0	2	4
6.		Elective - 3	3	0	2	4
<b>Total</b>			<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>
<b>ELECTIVES</b>						
M104	Power Electronics					
M105	Instrumentation & Process Control					
M106	Software Engineering I					
M107	Optoelectronics and Optical Fibre Communication Devices					

## M101 INDUSTRIAL DESIGN OF ELECTRONIC EQUIPMENT

L T P C  
3 0 2 4

### **Aim :**

This course is intended to prepare students to design products based on product design principles, guidelines and skills. Students will be given experience of designing products through case studies. At the end of the module students will communicate design concepts through sketches, virtual and physical appearance model.

### **Objective :**

To understand the various processes and systems to address human needs by creating tangible Electronic Products. To pursue learners with emphasis on learning-by-doing and following a comprehensive process of design, engineering and producing products and systems.

### **Outcome of the Course :**

After undergoing this course, students will be able to:

1. Design electronic products using user centered design process
2. Develop sketches, virtual and physical appearance models to communicate proposed designs
3. Refine product design considering engineering design & manufacturing requirements and constraints.
4. Make mock-up model and working prototype along with design documentation.

### **Theory**

**Introduction to Industrial Design :** General introduction in the course , role of ID in the domain of industry , product innovation, designer's philosophy and role in product design. Product development tools and methods.

**Product Design Methodology:** Electronic product design and development , Methodology, creativity techniques, brain storming, documentation.

**Product Planning :** Defining the task , scheduling the task, estimation of labor cost and amount of documentation.

**Ergonomics:** Ergonomics of electronics electronic use of ergonomics at work places and plat layouts, ergonomics of panel design, case study.

**Aesthetics :** Elements of aesthetics, aesthetics of control (ane) design.

**Visual Communication Techniques:** perspective , band sketching and rendering technique, elements of Engineering drawing , assembly drawing part drawing , exploded views

**Product Anatomy :** Layout design, structure design, standard and non standard structures, Industrials standards.

**Product Detailing :** Product detailing in sheet metal and plastics for ease of assembly ,

maintenance and aesthetics.

**Product Manufacturing** : Different manufacturing processes in sheet metal and plastics , product finishing , finishing methods like plating, anodization , spray painting , powder coating etc.

**Value Engineering** : Introduction to marketing , graphics & packing

**Lab Session** :

**Mini project** : An exercise in product design and development : Designs, Drawings, models, prototype of simple product.

### **Text Books**

1. Peter Z. , “*German Design Standard Vol 2*”, Reddot(2006)
2. Clarkson P. J, Coleman R. and Keates, S., “*Inclusive Design, Design for the whole population*”, Springer Verlag GmbH(2003)
3. Jordan P. W., “*Designing Pleasurable Products: An Introduction to the New Human Factors.*” Taylor and Francis(2002)
4. Otto K. and Wood K., “*Product design: Techniques in Reverse Engineering and New Product development*”, Prentice Hall. (2001)
5. Cross N. “*Engineering Design Methods: Strategies for Product Design*”, Willey.(2000)

### **References**

1. Cagan J. and Vogel C. M. (2007) Creating Breakthrough Products, “*Innovation from Product Planning to Program Approval*” . Pearson Education
2. Coats D. , “*Watches Tell More than Time: Product Design, Information, Quest for elegance*” McGraw Hill(2002)
3. Norman D. A. , “*The design of everyday things, Basic Books.*”(2002)
4. Chakrabarty D., “*Indian Anthropometric Dimensions for Ergonomic Design Practice*”, NID, Ahmedabad(1999).
5. Kelley T. and Littman J. “*The Art of Innovation: Lessons in Creativity from Ideo, America's Leading Design Firm, Doubleday*”, Ver: 4 November 2011 MI – PDN2524 Page 4 of 4 (2001)
6. E.J. McCormic, Human factors in engineering design, McGraw Hill 1976

### **Journals**

1. Behaviour & Information Technology, Taylor & Francis
2. The Journal of Sustainable Product Design, Publisher: Springer
3. International Journal of Design; College of Design, National Taiwan University of Science and Technology, Taiwan.
4. Virtual & Physical Prototyping, Taylor & Francis

### **Magazines**

- 1) ID
- 2) Form

### **Internet Sites**

1. <http://www.ulrich-eppinger.net/>
2. <http://www.npd-solutions.com>
3. <http://www.qfdi.org>
4. <http://www.cheshirehenbury.com/rapid/>

## **Electronic Product Design Lab**

1. Exercises on sketching and drawing, use of colors
2. Practice use of model making materials and processes
3. Practice methods and techniques of prototype making using sheet metal and plastic fabrication

## **M102 MICROCOMPUTER SYSTEM DESIGN**

**L T P C**

**3 0 2 4**

### **Aim:**

This subject focuses on essential skills in system design with Microcontrollers. The subject combines relevant theory, and hands on exercises in lab.

### **Objectives:**

1. To expose the students to the fundamentals of Microcontrollers 8086 and AVR
2. To enable students to develop, apply the Microcontrollers within Real life applications
3. To impart knowledge on fundamentals of functional units of a Processor

### **Outcomes:**

Upon completion of the course, students should be able to

1. Understand the basics of Microcontroller 8086 and AVR
2. Able to program with the Microcontroller for various applications
3. Able to interface various peripherals

### **Theory –**

**Processor architecture** : von- Neumann and howard architectures, RISC AND CISC

8086 processor architecture – Register model and Architecture of 8086/8088 , 8086/8088 hardware pin signals , bus buffering and latching , processor read and write cycles, ready and wait state generators.

**Memory and i/o interfacing to 8086/8088**: Address decoding and interfacing of memory (RAM & ROM ), to 8086/8088 processor, memory mapped i/o and i/o mapped i/o, i/o port address decoding and interfacing 8255A- programmable peripheral interface.

**Interrupts in 8086** : polling and interrupt driven input/output, mask able and non –mask able interrupts, software and hardware interrupts interrupt vectors and vector table, interrupt processing in 8086/8088

**Instruction set and programming** : Architecture of AVR microcontroller, general purpose registers , i/o registers and memories in AVR, addressing modes and instruction set, programming in assembly and C language.

### **AVR architecture and programming –**

Architecture of AVR microcontroller , general purpose registers , i/o registers and memories in AVR, addressing modes and instruction set, programming in assembly and C language .

**AVR peripherals** : Study and programming of AVR i/o ports , timer , serial port, spi port and i2c port.

**Interfacing of i/o devices to AVR** : interfacing of matrix keyboard, LCD module, seven segment displays and PC (through serial port.)

**Lab session :**

Programming exercise on AVR microcontroller in assembly and C language covering data processing , data transfer, program control instructions, interrupts, different peripherals ie i/o ports, timer, serial port, spi port etc  
Exercise on Interfacing of i/o devices ie LCD module seven segment displays , matrix keyboard etc.

**Text Books :**

- 1) Microprocessors & interfacing programming and Hardware : Douglas V.Hall . Tata McGraw Hill.

**References Books :**

- 2) Microcomputer and Principals hand book Vol. I & II : Intel corporation
- 3) Microcomputer system component hand bookvol I & II : Intel corporation
- 4) Adavanced MSDOS hand book : Ray Duncan's
- 5) CP/M hand book

**M103 ANALOG & DIGITAL SYSTEMS**

**L T P C**  
**3 0 2 4**

**Aim:**

Analog and Digital IC circuits are essential in interfacing and in building amplifiers and low pass filters. The aim of this course is to understand and design basic blocks of analog circuits, combinational circuits, sequential circuit,

**Objective:**

1. To study basic operational amplifiers.
2. To learn advanced digital design concepts.

**Outcome of the Course:**

At the completion of the course, students will be able to: Design various types of analog & digital circuits.

**Theory**

**Operational amplifiers :** Fundamentals, Ideal Op. Amp . Negative feedback in opamp. Various opamp configurations. Current to voltage and voltage to current converters. Current amplifiers. Difference amplifier. Instrumentation amplifier. Transducer bridge amplifier. Active filters. Static opamp limitations. Non linear circuits ; noise in opamps.

**Digital electronics:**

**Introduction :-** Logic families and their applications , TTL logic family etc

**Number System :-** Various types of number systems and codes.

**Logic Simplification :-** Boolean methods, and karnaugh map minimization method combinational and sequential logic, fuzzy logic , Quine Mc-clusky methods of simplification of logic.

**Lab session. :**

Measurements of op amp parameters , measurement of TTL circuit parameter, various practical based on above theory topics of analog and digital electronics .

**Text book :**

Design with operational amplifiers and analog integrated circuits. By Sergio Franco. Tata McGraw Hill publisher.  
Digital electronics by Charles H Roth

**Reference books :**

Analog electronics by Ramakanth Gaikwad  
Digital electronic by P.C. Jain

**M104 POWER ELECTRONICS**

**L T P C**  
**3 0 2 4**

**Aim**

Large electrical power is now days controlled electronically for higher efficiency and better accuracy. Power equipments like UPS, SMPS, Inverters, Battery chargers, DC/AC drives are widely used in industrial as well as domestic applications. It has entered in various fields of today's life which we cannot imagine without electric power. Hence, it is essential and helpful to have knowledge of Power Electronics.

**Objective**

To introduce the concepts of majority and minority carriers electrons and current flow.  
To study power devices, Power diodes, Transistors, Thyristors, their characteristics and protections.  
To understand the operation of SCR converters, Dual converters, AC voltage controllers, DC choppers. Single phase inverters Resonant inverter, McMurray Inverter. Single phase SCR cyclo converters . Online and off line UPS.

**Outcome**

Student will be able to learn the characteristic of power diode, transistors and Thyristors. Also they will be able to do experiments and testing related work related to single phase and three phase converters, Buck, Boost, Buck-Boost choppers, single phase cycloconverters, inverters and UPS.

**Theory**

**Power Devices :** Power diode , switching characteristics , Power transistor, Switching characteristics.

**Thyristor, switching characteristics:** triggering methods, turn off methods, protections. Heat sink and cooling of power devices. Devices in series & parallel.

**SCR Converters :**

Single phase SCR semiconverter with R, R-L & DC motor load single phase SCR full converter with R, R-L and DC motor load. Three phase SCR semiconverter with R, R-L load, Three phase

SCR full converter with R, & R-L load. SCR Dual converters. 4 quadrant operation. Closed loop DC drives .Synchronization , feedbacks and regulation , Regenerative Braking in DC drives.

**AC Controllers :** Stabilizer using relays, Triac based AC phase controller , Integral cycle control.  
DC Choppers : Buck Chopper, Boost chopper, buck-Boost chopper, Equivalent circuits and waveforms . SCR Jones chopper. Chopper based 1 & 2 quadrant servo drive.\

**Inverters:** Single Phase half bridge and full bridge inverter. Single phase SCR current source inverter. Variable DC link inverter .SCR series resonant inverter. McMurray Inverter, Murray-Bedford inverter.

**Cycloconverters:** Single phase SCR cycloconverter .Principle , waveforms.  
UPS- Power circuits of Online and Offline UPS. Principle of operation.

**Lab Session:**

- 1) Characteristics of mosfet.
- 2) Transfer characteristics of MOSFET ( Transconductance)
- 3) R & RC triggering of thyristor.
- 4) UJT triggering of thyristor.
- 5) R & RC triggering of triac.
- 6) UJT triggering of triac.
- 7) SCR parallel capacitor turn off.
- 8) SCR resonant cathode pulse turn off.
- 9) SCR Series capacitor turn off.
- 10) Study of series operation of power devices.
- 11) Study of parallel operation of power devices.
- 12) Study of Triac based AC phase controller.
- 13) Study of Single phase SCR semiconductor R load.
- 14) Study of single phase SCR fullconverter R-L load.
- 15) Study of Buck chopper .
- 16) Study of boost chopper.
- 17) Study of SCR resonant inverter.

**Text Books:**

Power Electronics by M. Rashid  
Fundamentals & Applications of Power Electronics by S.T. Valunekar

**Reference Books:**

Power Electronics by R. Ramshaw  
Thyristor DC Drives by Dr. P.C. Sen  
Power Semiconductor Circuits by Dewan & Straughen  
SCR Manual by General Electric

**M105 INSTRUMENTATION & PROCESS CONTROL**



**Aim :**

This course focuses on the application of electronics and computer technology to instrumentation, industrial automation, and process control systems. Commonly used sensing, transmission and final control elements are described and depicted in piping and Instrumentation Diagrams (P&IDs). The course is delivered through a combination of lectures and exposure to simulation programs currently used in industry.

**Objective :**

To impart knowledge about the various techniques used for the measurement of primary industrial parameters like flow, level, temperature, pressure etc

To give a detailed knowledge on transducer characteristics and uncertainties in measurement , application of different sensors /transducers their signal conditioning and final control elements for instrumentation and control systems

To elaborate different types of control schemes such as cascade control, feed-forward control

To give an overview of the features associated with Industrial Type PID Controller such as reset windup, bumpless auto-manual transfer, proportional kick and derivative kick.

**Outcome of the Course :**

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

Specify, design, implement and test analog signal conditioning and signal processing systems for industrial instrumentation and control functions.

Specify the required instrumentation and final elements to ensure that well-tuned control is achieved

Draw a PID (Process & Instrumentation Diagram)

**Theory:**

**Introduction sensors and measurement systems**

General concepts and terminology of measurement systems, static and dynamic characteristics, errors , standards and calibration .

Strain gauge, load cell, Torque Measurement, Thermistor Thermocouples, Resistance Temperature Detector, LVDT , capacitance Transducers, Flow meter, pressure sensors, Low pressure Measurement , pH and viscosity Measurement , Signal conditioning circuits sensors, smart sensors, chromatography, pollution measurement, Measurement of level, humidity , Moisture Measurement of acceleration , vibration.

**Climatologically Instrumentation :**

Instrumentation related to measurements of climatically variables like wind velocity, rain fall, humidity, temperature , radiation and atmospheric pressure.

**Introduction to process control .**

P-I-D control, controller Tuning , implementation of PID controllers

Special control structures : feed forward and Ratio control , predictive control: cascade control, overriding control, selective control, split range control

**Introduction to Actuators :** Flow control valves , Hydraulic actuator systems, principles, components and symbols, pumps and Motors, pneumatic control systems

**Piping and instrumentation** : P& ID objectives, guide rules, symbols, line numbering

**Lab session :**

Characteristics of RTD  
Characteristics of Thermistor  
Study of IC solid state Sensors  
Measurement of displacement using LVDT  
Measurement of Load using Load cell  
Study of pressure sensors  
Study of Thermopile  
Measurement of conductivity of a solution  
Study of PID controller  
Mini project using Temperature sensors.

**Text Books :**

1. D.Patranabis, principles of Industrial Instrumentation Tata McGraw Hill publishing Co., New Delhi,1999
2. R.K. Jain , Mechanical and Industrial Measurement , Khanna Publishers, New Delhi,1999
3. Curitis D. Johnson , process control instrumentation Technology, Prentice Hall of India.
4. John P. Bently , Principles of Measurement systems, third edition , Addison Wesley longman Ltd., Uk,2000

**References**

1. Ernest O. Doebelin, Measurement systems application and design international student edition, Tata McGraw Hill Publishing Co, New Delhi, 1999.
2. A.K. Sawhney, A course in electrical and electronic measurement and instrumentation – DhanpatRai and sons, New Delhi, 1999.
3. Eckman D.P. Industrial Instrumentation – Wiley Eastern Limited, 1990
4. Liptak B.G. Instrument Engineers Handbook ( Measurement), Chilton Book Co., 1994.
5. A. N. Westerberg, et al., Process flow sheeting , Cambridge University Press, 1979.
6. M. Sze, Semiconductor sensors , John wiley& sons Inc. , Singapore ,1994.
7. Noltingk B.E. Instrumentation Reference Book, 2<sup>nd</sup> Edition, Butterworth Heinemann, 1995
8. L.D. Goettsche, Maintenance of Instruments and systems – Practical guides for measurement and control , ISA, 1995.

**M106 SOFTWARE ENGINEERING-I**

**L T P C**  
**3 0 2 4**

**Aim:**

This subject focuses on essential skills in software system design and development .

**objectives**

To give an overview of the development of methodologies and steps to be followed for development of quality software.

## **Theory –**

### **Module I:**

Introduction – FAQs about software engineering – professional and ethical responsibility – system modeling – system engineering process – the software process – life cycle models – iteration – specification – design and implementation – validation – evolution – automated process support – software requirements – functional and non-functional requirements – user requirements – system requirements – SRS – requirements engineering processes - feasibility studies – elicitation and analysis – validation – management.

### **Module II:**

System models – context models – behavior models – data models – objects models – CASE workbenches – software prototyping – prototyping in the software process – rapid prototyping techniques – formal specification – formal specification in the software process – interface specification – behavior specification – architectural design – system structuring – control models – modular decomposition – domain specific architectures

### **Module III:**

Object-oriented design – objects and classes – an object oriented design process case study – design evolution - design with reuse – component based development – application families – user interface design – design principles – user interaction – information presentation – user support – interface evaluation.

### **Module IV**

Software testing – defect testing – integration testing – object-oriented testing – testing workbenches – software change – software maintenance – architectural evolution – software re-engineering – data re-engineering.

**Module V:**

Software project management – project planning – scheduling – risk management – managing people – group working – choosing and keeping people – the people capability maturity model – software cost estimation – productivity estimation techniques – algorithmic cost modeling – project duration and staffing quality management – quality assurance and standards – quality planning – quality control – software measurement and metrics – process improvement – process and product quality – process analysis and modeling – process measurement – process CMM

**Text Book**

1. Ian Somerville, Software Engineering, Pearson Education Asia.

**Reference books**

1. Pressman R.S, Software Engineering, McGraw Hill
2. Jalote P, An Integrated Approach to Software Engineering, Narosa
3. Mall R, Fundamentals of Software Engineering, Prentice Hall India

**M107 OPTOELECTRONICS AND OPTICAL FIBRE COMMUNICATION DEVICES****L T P C****3 0 2 4****Aim**

To introduce the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.

To study about various optical sources and optical detectors and their use in the optical communication system. Finally to discuss about digital transmission and its associated parameters on system performance.

**Objective**

To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.

To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.

To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.

To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.

To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

**Outcome;**

- 1) After finishing the course student will become familiar with all components of optical fiber system like sources, detector and optical fiber
- 2) Students will become knowledgeable about the working principal of above devices.
- 3) Student will get knowledge about the construction mechanism and selection criteria of Optical fiber cables.

**Theory****Introduction:**

Light theory , propagation of light in anisotropic media, light propagation in wave guides. Fiber optics- types of fibers, characteristics, fabrication and testing of optical fibers.

Laser Devices:

Historical introduction , emission and absorption of radiation , spontaneous and stimulated emission , population inversion optical feedback , the laser resonator , Various gas, solid state semiconductor lasers and their properties, application in brief.

**Opto electronics sources and Detections:**

Light emitting diodes –LED for different colours, behavior at high frequencies, Injection laser diodes, Basic Homojunction laser, Double hetro junction laser optional gain in semiconductor detectors, photoconductors photo diodes , quantum efficiency, P.I.N. diode , frequency response, pulse response, APO , Meterials and wavelength selection , band width and noise consideration , PINFET

**Opto Electronics Instructions:**

Laser interferometry and application to metrology and testing , Holography and holographic interferometry, speckle techniques. Digital speckle pattern interferometer, Laser gyro and Doppler vaelocimetry, OTDR, LIDAR applications. Optoelectronic devices in medicine, Industry , and agriculture brief.

**Lab session :**

Measurement on Optical sources LED, Laser Diode and photo defectors  
He Ne Laser beam Characteristics study  
Optical fiber characteristics.  
Holographic and speckle experiments

**Text Book**

1. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

**Reference Book**

1. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
2. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

## SEMESTER II

SL No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	M201	Project Feasibility Seminar	2	0	0	2
2.	M202	Advanced Microcomputer System Design	3	0	2	4
3.	M203	Physical Design of Electronic Equipment	3	0	2	4
4.		Elective - 4	3	0	2	4
5.		Elective - 5	3	0	2	4
6.		Elective - 6	3	0	2	4
<b>Total</b>			<b>17</b>	<b>0</b>	<b>10</b>	<b>22</b>
<b>ELECTIVES</b>						
M204	Agri Instrumentation & Control					
M205	Advanced Power Electronics					
M206	Software Engineering II					
M207	Optoelectronics and Optical Fibre Communication System					

### M201 PROJECT FEASIBILITY SEMINAR

**L T P C**

**2 0 0 2**

The Project Feasibility Seminar would enable the student to choose project on the basis of innovation, concept, feasibility, cost, utility, and conversion into an industrial product .

### M202 ADVANCED MICROCOMPUTER SYSTEM DESIGN

**L T P C**

**3 0 2 4**

**Aim:**

This subject focuses on skills in system design with Advanced Microcontrollers. The subject also introduces to Real time operating system

**Objectives:**

1. To have detailed knowledge about operating systems
2. To expose the students to the fundamentals of Microcontrollers 80286/386 and ARM
3. To enable students to develop, apply the Microcontrollers within Real life applications
4. To impart knowledge on fundamentals of functional units of a Processor
5. To have exposure to work in Real time operating systems

**Outcomes:**

Upon completion of the course, students should be able to

- 1 Understand the basics of Microcontroller 80286/386 and ARM
- 2 Able to program with the Microcontroller for various applications
- 3 Able to interface various peripherals
- 4 Able to program in RTOS

**Theory**

**Introduction to operating system :** Operating system objectives, operating system structure and services.

**The 80386 processor Architecture:** General features of advanced Microprocessors, the architecture and features of the 80386 processor, protected virtual address mode. Segmentation and segment descriptor tables, segment selectors and descriptors, protection model, data access and control transfer, Memory management , address translation.

I/O and interrupts in 80386 protected mode – I/O level protection , protected mode interrupts and exceptions , their properties and interrupts /exceptions transfer methods.

**Multitasking :** task state segment and task switching .

**Architecture of ARM processor :** ARM processor modes, register organization, exceptions and its handling, memory and memory mapped i/o , addressing modes, arm & thumb instruction sets, arm and thumb inter working , programming in assembly and C language.

Architecture support for higher level language and operating system – support in architecture for higher level language and operating system , memory protection unit and memory management unit, cache memory concepts.

**Lab session :**

Programming exercises on 80386 and ARM processors in assembly language covering data processing , data transfer , program control instructions.

**References Books :**

- 1) 80286 Hardware Reference Manual :Inter corporation
- 2) Microprocessor & principal Hand book Vol. I& II :Inter corporation
- 3) 80286 software reference Manual :Inter corporation

## M203 PHYSICAL DESIGN OF ELECTRONIC EQUIPMENT

L T P C

3 0 2 4

### **Aim:**

To make aware of different technologies used in PCB Manufacturing.

To apply design rules of PCB design in different type of applications like RF, Power Electronics circuits.

To understand different electromagnetic Interference problems occurring in PCBs and sub systems and to overcome these issues by applying design rules.

To provide necessary practical skill of Designing PCBs of different electronic circuits

To understand an integrated approach to quality specification, quality control, monitoring, and reliability.

### **Objective:**

To understand the concept of Design for manufacturing ,Design for assembly and Design for reliability to meet the requirement of Electronic Product.

To use various EDA tool PCB Design and Product Design.

To make aware of Trends used in this area and to make aware the industrial Environment in Product Design and Development.

### **Outcome of the Course:**

1. Can organize and manage the quality of products design and production processes, costs, customer satisfaction etc.,
2. Can perform quality optimization, during the design phase of a product or improvement phase.
3. Can assess the improving reliability of products or production process.
4. Can ensure the safety of products or Production processes
5. Use PCB design tools to fabricate a board.
6. Can start their own Unit in PCB Design and Manufacturing as well as in Electronic Product Design and Development.

### **Theory**

#### **Mechanical Design :**

Product development cycle. Role of physical design in product development process. Various design considerations like static strength, dynamic stability, Manufacturing, assembly, Maintenance, Safety, Reliability, Heat Dissipation, EMI/ RFI Shielding, standardization & Fcommonous, Various enclosure standards like DTN 41494 , IEC 297 & N.S. 5954. Selection of Materials and processes. Manufacturing Tolerances and is 919: 1962 .Introduction to value Engineering.

#### **PCB Design:**

Design rules for analog circuits, digital circuits, power circuits with connectors. Design rules high frequency circuits , Matching of conductors, line defects, rise time limitations, dielectric losses, radiation losses. Introduction to Design rules for microwave applications.

A) Drawing : Limitations pf manual design, PCB design using CAD packages.

B) Production : Fabrication of SSB, DSB < MLB and PTH plating , copper clad limitaitons stress and strain analysis for assembled PCBs. SMD techniques.



**Thermal Design** : Conduction, convection , thermal design of electronics equipments and case studies.

**Lab session :**

Preparation of various product documents like assembly drawing , part details in accordance with ISBNBL-7001-091-2.

Total design and fabrication of SSB and DSB.

**Text books:**

1. W Bosshart, “*Printed Circuit Boards - Design & Technology*”, 1st edition, Tata McGraw Hill
2. Bralla, “*Design for Manufacture Handbook*”, McGraw hill, 1999.
3. Henry W.Ott, “*Noise Reduction Techniques in Electronic Systems*”, 2nd edition, John Wiley & Sons.
4. Boothroyd, G, Hertz and Nike, “*Product Design for Manufacture*”, Marcel Dekker, 1994.
5. Martin Helander, A guide to the ergonomics of manufacturing, East West press, 1996

**References:**

1. Boothroyd, G, Hertz and Nike, “*Product Design for Manufacture*”, Marcel Dekker, 1994.
2. D.E. Walsh, “*Do It Yourself Vacuum Forming for the Hobbyist, Workshop Publishing*”, Lake Orion, MI, 2002
3. E.J. McCormic, Human factors in engineering design, McGraw Hill 1976
4. PCB Design Guidelines For Reduced EMI; Application note SZZA009@<http://www.ti.com>

## M204 AGRI INSTRUMENTATION & CONTROL

L T P C  
3 0 2 4

**Aim :**

The course aims at providing the student with a better understanding of Digital Process Control and Automation techniques using Programmable Logic Controllers /Distributed Control Systems for applications pertaining to Industrial Automation . Case studies of process industries like Paper,Sugar Dairy are studied

**Objective :**

To discuss the architecture of an industrial automation process  
To enable the student to gain experience in data acquisition and instrument control  
To give an overview of the Industrial data communications systems  
To provide a fundamental understanding of common principles, various standards, protocols  
To make the student become competent in using state-of-the-art VI tools.

**Outcome of the Course :**

After undergoing this course, students will be able to:  
Select and use most appropriate technologies and standards for a given application  
To develop software programs called VI  
To demonstrate the principles of ladder logic/SCADA interface programming.

## **Theory**

**Review of computers in process control:** Data loggers, Data Acquisition systems (DAS) , Direct Digital Control (DDC). Supervisory control and data acquisition systems(SCADA), sampling considerations. Functional block diagram of computer control systems. Alarms, interrupts.

**Programmable logic controller ( PLC) basics:** Definition, overview of PLC systems, input/output modules, power supplies , isolators, general PLC programming procedures, functions: Register basics, timer functions, counter functions.

**Virtual Instrumentation:** Historical perspective , advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming . Development of virtual instrument using GUI, Real-time systems.

### **Industrial communication systems:**

**Interface:** Introduction, principles of interface, serial interface and its standards. Parallel interfaces and buses.

**Field bus:** Use of field buses in industrial plants, functions, international standards, performance, use of Ethernet networks, field bus advantages and disadvantages. Field bus design , installation , economics and documentation.

**Instrumentation network design and upgrade :** Instrumentation design goals, cost optical and accurate sensor networks. Global system architectures, advantages and limitations of open networks, HART network and Foundation field bus network.

**Profibus –PA :** Basics, architecture , model , network design and system configuration. Designing PROFIBUS-PA and Foundation field bus segments : general consideration ,network design.

### **Application of PC based instrumentation and control systems for:**

**Green House:** History of modeling and control of green house, Importance mathematical modeling of green house, identification of control and manipulation variables for green house, development of mathematical model based on identified variables for green house, control systems for green house climate and soil nutrients control.

**Crop Preservation :** Importance of Preservation of various commodities and part of the plants. Drying processes for preservation . Mathematical relations governing drying, process , Applicability of mathematical relations in electronic control system for drying process. Variable identification for drying process, Generalized drying system concepts. Importance of grape drying systems in Indian context. , Electronic control systems for grape drying process.

**Dairy, Sugar and paper industry:** Study of overall processing concepts of individual industry and process steps study, study of variables characterizing various process steps and their identification , electronic automatic control systems for various process steps related to these industries.

### **Lab session:**

Modelling of green house and controller design using model developed, controlling green house parameters using online measurement and control system. Complete design , analysis  $K_i$ ,  $K_p$ ,  $K_c$  ,  $T_i$ ,  $T_d$  sampling rate.

Learning Lab view: Introduction to lab VIEW , front panel , block diagram, Menus, palettes, VI & sub VI, Editing & Debugging VI, structures , Arrays , clusters, Charts & Graphs , Data acquisition , signal generation & processing examples.

### **Text Books:**

1. John . W. Webb Ronald A Reis, Programmable Logic Controllers- Principles and applications, Third edition , prentice Hall Inc. New Jersey,1995.
2. Lukcas M.P. Distributed Control systems, Van No strand Reinhold co., New York, 1986.
3. Gray Johnson, Lab VIEW Graphical Programming , second edition, McGraw Hill, New York, 1997.
4. Lisa K.wells& Jeffrey Travis, Lab VIEW for everyone, prentice Hall, New Jersey, 1997.
5. Romilly Bowden, HART communication protocol, (fisher-Rosemount).
6. User Manuals of foundation field bus, profibus, Modbus, Ethernet, Device net, control net.

### **References:**

1. Deshpande P.B. and Ash R.H , Elements of process control applications, ISA press, New York,1995
2. Noltingk B.E., Instrumentation Reference Book, 2<sup>nd</sup> Edition , Butterworth Heinemann, 1995.

## **M205 ADVANCED POWER ELECTRONICS**

**L T P C**

**3 0 2 4**

### **Aim**

Power equipments like UPS, SMPS, Inverters, Battery chargers, DC/AC drives are widely used in industrial as well as domestic applications. Use of advanced devices like IGBT, GTO and advanced brushless DC drives and V/f AC drives is increasing. Hence, it is essential and helpful to have knowledge of all these.

### **Objective**

To introduce the concepts of electrical active and re-active power.

To introduce the concept of power factor.

To study power devices, Insulated Gate Bipolar Transistors, Gate turn off Thyristors.

To understand the operation of series connected SCR converters, DC chopper based servo drives.

Brushless DC drives. V/f and Vector control of induction motors. Online and off line UPS.

Induction heating. Switch mode Power Supply. Various types of controllers.

### **Outcome**

Student will be able to learn the characteristic of IGBT and GTO. Also they will be able to do experiments and testing related work related to DC choppers, inverters ,UPS,SMPS and various types of P, D, P-D, I, P-I,P-I-D controllers.

### **Theory**

**Power devices:** Power Mosfet, construction and characteristics.IGBT construction & Characteristics. GTO construction &characteristics, Turn off action.

**SCR Coverters :** Methods of power factor improvement in converters. Series connected converters. Identical and sequence control.

**Drivers : Brushless dc motor drives. Phase locked loop controlled drives.**

DC choppers : Voltage commutated., current commutated & load commutated choppers, Equivalent circuits, formulae waveforms. Methods of harmonic reduction etc.

**Choppers** . Chopper based 3& 4 Quadrant servo drive.

Inverters: Three phase half bridge and full bridge inverter. Methods of harmonic reduction in inverters.

**Cycloconverter** : Methods of harmonic reduction in cycloconverter. Three phase SCR cycloconverter. Principle , Waveforms.

**Induction motor speed control:** V, f, V/f, and Vector control methods.

**UPS:**Power circuits of Online and Offline UPS: Principle of operation. Batteries and Battery charges. Induction heating , switch mode power supply , Resonant dc power supply.

**Controllers:** P,D, P-D, I,P-I, P-I-D controllers Various mathematical examples on above topics.

**Lab session:**

- 1) Characteristics of IGBT.
- 2) Study of single phase SCR semi converter DC motor load.
- 3) Study of single phase SCR full converter DC motor load.
- 4) Study of three phase SCR full converter R motor load.
- 5) Study of three phase SCR full coverter R-L motor load.
- 6) Study of Buck-Boost chopper.
- 7) Study of voltage commutated chopper.
- 8) Study of current commutated chopper.
- 9) Study of PWM controller.
- 10) Study of single phase full bridge inverter.
- 11) Study of SMPS
- 12) Study of UPS
- 13) Study of variable frequency inverter
- 14) Study of P-I controller
- 15) Study of P-I-D controller

**Text Books:**

Power Electronics by M. Rashid

Fundamentals & Applications of Power Electronics by .T. Valunjkar

**Reference Books:**

Power Electronics by R. Ramshaw

Thyristor DC Drives by Dr. P.C. Sen

Power Semiconductor Circuits by Dewan & Straughen

SCR Manua General Electric

Power Electronic control of AC motors JMD Murphy and Turnbull

**Aim:**

This subject focuses on essential skills in software system design and development .

**objectives**

Your studies will enable you to develop:

- A broad and critical understanding of all the processes for engineering high quality software and the principles, concepts and techniques associated with software development
- An ability to analyze and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems
- Students will demonstrate knowledge of the distinction between critical and non-critical systems.
- Students will author a software requirements document. Students will demonstrate proficiency in software development cost estimation.
- Students will author a software testing plan.
- Students will demonstrate the ability to manage a project including planning, scheduling and risk assessment/management.

**Module I:**

**Software Requirements:** What and Why Essential Software requirement, Good practices for requirements engineering, Improving requirements processes, Software requirements and risk management .**Software Requirements Engineering** Requirements elicitation, requirements analysis documentation, review, elicitation techniques, analysis models, Software quality attributes, risk reduction through prototyping, setting requirements priorities, verifying requirements quality.

**Module II:**

**Design Engineering:** Design process and Design quality, Design concepts, the design model, pattern based software design. Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural Design, assessing alternative architectural designs, mapping data flow into a software architecture. **Modeling component-level design:** Designing class-based components, conducting componentlevel design, Object constraint language, designing conventional components. **Performing User interface design:** Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

**Module III:**

**Software Estimation:** Components of Software Estimations, Estimation methods, Problems associated with estimation, Key project factors that influence estimation **Size Estimation** Two views of sizing, Function Point Analysis, Mark II FPA, Full Function Points, LOC Estimation, Conversion between size measures, **Effort, Schedule and Cost Estimation** What is Productivity? Estimation Factors, Approaches to Effort and Schedule Estimation, COCOMO II, Putnam Estimation Model, Algorithmic models, Cost Estimation

**Module IV:**

**Requirements Management Tools:** Benefits of using a requirements management tool, commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation, Software Estimation Tools: Desirable features in software estimation tools, IFPUG, USC's COCOMO II, SLIM (Software Life Cycle Management) Tools **Risk management: Quality Management: Configuration Management**

**Module V:**

**Security and Complexity:** System Assembly Challenges: introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security UNIT – V **Governance and Managing for More Secure Software:** Governance and security, Adopting an enterprise software security framework, How much security is enough?, Security and project management, Maturity of Practice

1. Software Engineering: A practitioner's Approach, Roger S Pressman, sixth edition. McGraw Hill International Edition, 2005 2.
2. Software Engineering, Ian Sommerville, seventh edition, Pearson education, 2004.
3. Software Security Engineering: Julia H. Allen, Pearson Education

**REFERENCE BOOKS:**

1. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
2. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
3. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International edition, 2006.
4. Software Engineering Foundations, Yingxu Wang, Auerbach Publications, 2008.
5. Software Engineering 3: Domains, Requirements and Software Design, D.Bjorner, Springer, International Edition.
6. Software Requirements and Estimation by Rajesh Naik and Swapna Kishore, Tata Mc Graw Hill

**M207 OPTOELECTRONICS AND OPTICAL FIBRE COMMUNICATION SYSTEM**

**Aim**

To study basics of various concepts of optical electronics i.e. integrated optics, acousto-optic and electro optics effects.

To study about laser system, mainly about semiconductor lasers.

To study about the design of a Optical fiber link for voice, video and data, with in-depth study about transmitter and receivers.

To study about different sensors system designed and developed using optical fiber and there uses. Latest trends in Optical Fiber Communication.

**Objective**

- 1) To be able to design transmitter and receiver circuit of the optical fiber link.
- 2) Should get aware of the criteria of selection of optical fiber cable in an optical link
- 3) Should get the knowledge about difference in video, voice and data transmitter system.
- 4) Should get the concepts of other optoelectronics techniques like acousto-optics, electro optics and Integrated Optics.

**Outcomes**

- 1) The student will be able to design transmitter circuits, receiver circuit and selection of optical fiber cable for a given conditions of the optical fiber link.
- 2) Should have the knowledge about selection of optical fiber and optical fiber cable for different type of an optical link, with having application for voice, video or data transmission.
- 3) Will have knowledge of other optoelectronics techniques like acousto-optic acousto-optic , electro optics and Integrated Optics.

**Theory****Laser system:**

Design and fabrication of various laser system an over view, fabrication of semiconductors laser system , power supplies for laser system and mechanical considerations.

Optical phenomēn& System:

**Electro optics and non liner optics effects:** acousto electro, Design of A.O modulators and deflectors. Flectro- optic effects- pockets and kerr effects : change in refractive index in KDP crystal . Design of electro optional modulators, switching , multiplexers and other devices. Integrated optical circuits, materials and design of specific PO system , applications

**Optical communication systems and design:**

Optical fibres and other components for fiber optic communication , fiber optic communication system dosing power budget and rise time consideration .Transmitter & receiver circuits. Fiber optics system for voice , video and data communication – design examples. Optical amplification , coherent communication, photonic switching, solutions and other new development –brief discussion .

**Optical sensors and systems:**

An overview of various optoelectronic sensing techniques used in scientific , medical and industrial fields. Opto-electronic transducers, types and properties , design consideration of intensity and interferometric types of fiber optic sensors for pressure , strain, rotation, temperature , current and magnetic fields etc.

High speed communication (optical )& optical Networks

**Lab session:**

Fiber optic communication (transmitter & receiver design ) fiber optic sensors design  
 Measurements on communication components.  
 Design and calibration of power meters.

**Text Book**

1. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

**Reference Book**

2. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
3. Fundamentals of Photonics 2nd ed., Saleh and Teich, (John Wiley & Sons, inc., 2007)
4. T. Tamir, *Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.*

**SEMESTER III**

SL No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>PROJECT WORK</b>						
1.	PROJECT WORK and SEMINAR		0	0	32	16
<b>TOTAL : 16 CREDITS</b>						



## SEMESTER IV

SL No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>PROJECT WORK</b>						
1.		PROJECT WORK and SEMINAR	0	0	36	18
<b>TOTAL : 18 CREDITS</b>						

### **Objective**

To enable the student

To make comprehensive use of the technical knowledge gained from previous courses.

To apply project management skills (scheduling work, procuring parts, and documenting expenditures and working within the confines of a deadline).

To communicate technical information by means of written and oral

The Cambridge IGCSE Design and Technology syllabus enables learners to identify, consider and solve problems through creative thinking, planning and design, and by working with different media, materials and tools. As a result, learners gain greater technical and design awareness, while developing skills such as initiative, resourcefulness, enquiry and ingenuity. They also develop the communication skills central to design making and evaluation. Cambridge IGCSE Design and Technology provides an ideal basis for further study, and prepares learners for their future within a rapidly changing tech...