

SYLLABUS
OF
POST DIPLOMA COURSE
IN
ELECTRONICS PRODUCT DESIGN &
TECHNOLOGY
BATCH 2013 ONWARDS

PUNJAB TECHNICAL UNIVERSITY
JALANDHAR

Submitted by

Board of Studies Electronics and communication Engineering

Eligibility Criteria

Eligibility criteria for this course are as given hereunder: -

- Diploma in Electrical/Electronics/Computer/Instrumentation or equivalent or B.Sc. (Electronics/Computer/Physics/Instrumentation) from recognized University.
- The maximum age limit for admission shall be 27 years reckoned on 1st July / 1st January of the Academic Year. There is no age bar for admission to this Course for working / sponsored candidates.
- Reservation of seats shall be as per Government of India norms. If adequate number of candidates belonging to reserved categories are not available, seats will be filled with other eligible candidates.

EXAMINATION:

- As per PTU norms.

COURSE & EXAMINATION SCHEME

1st Semester

Course Code	Course Title	Load Allocation				Marks Distribution		
		L	T	P	Credit	Internal	External	Total Marks
PD-101	Analog Circuit Design	3	1	-	4	40	60	100
PD-102	Digital Circuit Design	3	1	-	4	40	60	100
PD-103	Designing with Power Devices	3	1	-	4	40	60	100
PD-104	Microcontroller Based Embedded System	3	1	-	4	40	60	100
PD-105	Measurement and Display Devices	4		-	4	40	60	100
PD-106	Laboratory – 1(PD-101, PD-102)	-		6	3	30	20	50
PD-107	Laboratory – 2(PD-103, PD-104 & PD-105)	-		6	3	30	20	50
	TOTAL	16	4	12	26	260	340	600

2nd Semester

Course Code	Course Title	Load Allocation				Marks Distribution		
		L	T	P	Credit	Internal	External	Total Marks
PD-201	Real Time Embedded System Design	4	-	-	4	40	60	100
PD-202	Manufacturing Technology	4	-	-	4	40	60	100
PD-203	Electronic Product Design	3	1	-	4	40	60	100
PD-204	Reliability of Electronic Equipments	3	1	-	4	40	60	100
PD-205	Laboratory – 3(PD-201 & PD-202)	-		6	3	30	20	50
PD-206	Laboratory – 4(PD-203 & PD-203)	-		6	3	30	20	50
PD-207	Project & Dissertation					60	40	100
	TOTAL	14	2	12		280	320	600

Detailed Syllabus

PD-101 ANALOG CIRCUIT DESIGN:

Overview of Active and Passive Components, Semiconductor Devices (Diode, Transistor, FET), Design of various types of Amplifiers, Multivibrators and Power Amplifiers using Integrated Circuits such as IC555, IC LM380 etc.

Operational Amplifier characteristics, Detail Description of IC 741 Op Amp, Practical Design Procedure for the Op Amp, Designing of Summing, Instrumentation, Bridge and Differential Amplifier using 741, Designing of Current to Voltage and Voltage to Current Converter using 741, Designing of Storage circuit .i.e. Peak Detector and Sample-Hold Circuit using IC 741, Designing of Voltage Comparator Using Op Amp, General Characteristics of Active Filter Types and Design Techniques

Physics of Light and Light Sources, Physics of Direct and Indirect Band Gap Semiconductors, Introduction to Opto Electronics and Liquid Crystal Devices like Photodiodes, Phototransistors, Opto Couplers, 7-Segment Display, Alphanumeric Display, LCD display, Introduction to Electronic Display Wall, Design and Construction of 7-Segment Display, LCD, Alphanumeric Display and their Drive Circuit for Message Display.

EXPERIMENT LIST:

1. Study of lab equipment and components: CRO, Multimeter, Function Generator, Power supply-Active and Passive Components & Bread Board, Soldering WorkStation.
2. Assemble LED to display “NIELIT” on a General Purpose PCB
3. Design Astable, Bistable, Monostable Multivibrator Circuit using IC 555.
4. Design Audio Power Amplifier using IC LM380
5. Design Current to Voltage and Voltage to Converter using Op Amp 741.
6. Design a Regulated Power Supply for $\pm 5V$ using IC7805 and IC7905

RECOMMENDED BOOKS:

- **Millman**, Electronic Devices and Circuits, 2nd ed., Electronic Devices & Circuits, Tata Mcgraw Hill.
- **R. S. Khandpur**, “Troubleshooting Electronic Equipments”, Tata Mcgraw Hill.
- **Boylested**, “Electronic Devices And Circuit Theory”, 9th ed., Pearson Education.
- **Floyd**, “Electronic Devices: Conventional Current Version”, 7th ed., Pearson Education.
- **Robert F. Coughlin & Fredrick F. Driscoll**, “Operational Amplifiers and Linear Integrated Circuits”, Prentice Hail of India Pvt. Ltd.
- **K.R.Botkar** “Integrated Circuits”, Khanna Publishers
- **A.P.Godse, U.A. Bakshi**, “Linear and Digital IC Applications”, 1st ed., Technical Publication Pune.
- **Data Sheet of IC 555, IC380, IC741, IC723, IC78XX, IC79XX**



PD-102 DIGITAL CIRCUIT DESIGN:

Overview of Number System, Boolean Algebra, Logic Gates, K-Map, Digital Logic Families, Half Adder, Full Adder/ Sub-tractor, Multiplexers, De-multiplexer, Combinational Circuit Design using SSI/MSI/LSI chips and their Applications.

Designing of Flip-Flops, Counters, Latches, Buffers, Shift Registers, Finite State Machine based Design, Synchronous and Asynchronous Designing Concept, Excitation Table based Sequential Circuit Design, Designing of Sequential Circuit using SSI/MSI/LSI chips and their Applications, ALU design with IC 74181

Semiconductor Memories : Memory Organisation, Memory Classification, Characteristics and Internal Architecture, Read/Write Operation, , Expanding Memory Size, Word Size, and Word Capacity, Sequential Memories, Content Addressable Memories (CAM) and Operation, Sequential Memory and Operation, ROM Organization and Operation, ROM ICs, Read and Write Memory, Programming Mechanisms, Bipolar RAM Cell, MOS RAMs, RAM ICs, Charge Coupled Device Memory, Basic Concept of CCD Operation and Applications, Reconfigurable Computing Concept and their Application in PLA, PLD, CPLD and FPGA.

Introduction, DAC Parameters, Weighted and R-2R Ladder DAC Method, ADC Parameter Successive Approximation ADC Method, Parallel or Flash ADC Method, Dual Slope ADC Method, Designing of DAC IC800, Designing of ADC with IC 0808/0809

Introduction to VHDL Programming for Simple Digital Circuit Simulation

EXPERIMENT LIST:

1. Realization of Truth-Table of all Logical Gates using IC7400, IC7408, IC7432, IC 7486, IC 7404, IC 7402 and IC 74266
2. Design a four bit Adder-Subtraction circuit with mode control “M” using IC7486 and IC HEF4008B having condition of Addition when $M = 0$ and for Subtraction $M = 1$
3. Design a Numeric Display System for displaying 0 to 9 using IC 7447 and 7 Segment Display chip.
4. Design a 4-Bit Decade Counter Using IC 7490
5. Design a 4-Bit Decade Up/Down Counter Using IC 74192
6. Realization of Operation of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.
7. Realize the function of ALU using IC 74181
8. Design an 8-Bit DAC using IC 0800
9. Design an 8-Bit ADC using IC 0808/0809
10. Write Down VHDL Code for following
 - i.) For SR, JK, T and D Flip-Flops
 - ii.) For 2 Bit Binary Multiplication
 - iii.) For 4-Bit Numerator and 2-Bit Denominator Divider

RECOMMENDED BOOKS:

- **R.P.Jain**, "Modern Digital Electronics", 3rd Ed., Tata McGraw Hill Publication
- **A.P.Godse, D.A. Godse**, "Digital IC Applications", Technical Publication Pune.
- **A.P.Godse, U.A. Bakshi**, "Linear and Digital IC Applications", Technical Publication Pune.
- **Morris Mano & Michael D. Ciletti**, "Digital Design", 4th Ed., Pearson Education.
- **Floyd Thomas L.**, "Digital Fundamentals", 8th ed., Pearson Education.
- **Charles Roth, Jr., Larry L. Kinney**, "Fundamentals of Logic Design", 6th ed., Cengage Learning
- **Data Sheet of 74 Series SSI/MSI/LSI Digital ICs as mentioned in lab exercises**
- **Data Sheet of DAC IC 0800 and ADC IC 0808/0809**



PD-103 DESIGNING WITH POWER DEVICES:

Introduction to Power Electronics, Construction, Operation, Electrical Characteristics and Applications of SCR, DIAC, TRIAC, GTO, MTO, ETO, IGCT, IGBT, RCT, MCT, SITH, LASCR, Solar cells as power source devices and their characteristics, Protection Circuits used for Power Electronics Semiconductor Devices.

Transformer Design : Fundamentals, Selection of core material, Insulating material and wires, Design Methodology of pulse transformers, High Frequency transformers, Design of Transformers for PWM converters.

Coil : Fundamentals, Selection of core material, Insulating materials and wires, Design of inductors for power frequency, Radio frequency & High frequency.

Regulated and Switch Mode Power Supplies : Basic Circuit Configuration and Characteristics of Series, Shunt and Adjustable/Automatic Regulators, Current Limiting and Current Boosting Regulator, Regulator, Introduction to Switching Regulator, Regulator Circuit Design using IC 723, IC78XX and IC79XX.

Basic regulators-Buck, Boost, Buck Boost, Derived topologies-fly back, forward, Push pull, half & full bridge converter, special converters, PWM control techniques, study of PWM control ICs, design of base drive circuits, design of input section, output section & control section, thermal design concepts, EMI/ EMC consideration, protection circuit design for power supplies.

UPS and Other Power Supplies : Concept of AC & DC resonant power supplies, concept of AC & DC bidirectional power supplies, design concept of uninterrupted power supplies, CVT.

EXPERIMENT LIST:

1. Design and testing of
 - i.) 230Volt, 50Hzs AC to 9Volt, 50 Hzs Step Down Transformer
 - ii.) Construct a 5Volt DC Regulated Power Supply using this Transformer and IC 78xx
2. Trace the circuit diagram and interconnect of
 - i.) 1KVA Online UPS and draw it.
 - ii.) 1KVA Offline UPS and draw it.
3. Trouble Shoot a 600-800 Watt faulty home UPS and make it operational

RECOMMENDED BOOKS:

- **George Chryssis**, “High Frequency Switching Power Supplies: Theory & Design”, Mc Graw Hill Publication, 1989.
- **K. Kitsum**, “Switch Mode Power Conversion - Basic Theory and Design”, Marcel Dekker Inc. Publication, 1984.
- **M.H.Rashid**, “Power Electronics Circuit Device and Application”, 3rd ed., Pearson Education Publication.
- **White Papers and Data Sheets of referred Manufactures Devices and Equipment’s**



PD-104 MICROCONTROLLER BASED EMBEDDED SYSTEM DESIGN:

Introduction to Micro-Computer based System Design, Comparison between Micro-Processor (μ P) and Micro-Controller (μ C), Characteristics, Categories and Differences, Embedded and Non Embedded System Definition, Types and Design Concept, Hardware-Software Design Concept, Programming Languages for Micro-Controller (μ C) Based System Design, Assembly Language and Embedded-‘C’, their Advantages and Disadvantages, Simple Examples, Micro-Controller based System Design Issues and Challenges.

Micro-Controller and Programming in Assembly Language : Van-New-Mann and Harvard Architecture, RISC, CISC, ASIPs, Super-Scalar, VLIW, and DSP Microcontroller Architecture, their Examples, Detail Architecture of 8-Bit Micro-Controller (μ C) Families from Intel, PIC, ARM and ATMEL, their Characteristics, Categories, Comparison and Differences, Addressing Modes, Types of 8051 Instruction Sets and their Applications and their Programming using Assembly Language.

8051 Micro-Controller : 8051 Flag Bits, PSW Register, Register Banks and Stacks, Memory Organization, Counters, Timers, Input/output Ports, Interrupts, Parallel-Serial Communication with 8051, 8051 Interfacing Concepts, Programming and its Application.

Embedded-‘C’: Introduction, Data Types, Constants, Variables and Enumerated Data Types, Flow Control, Functions, Bit Operation, Arrays, Pointers, Dynamic Memory Allocation, File Handling Concepts and Data Structures, Sorting and Searching Techniques, Timers and Interrupts, Concept of Parallel-Serial Interface and Communication, Applications of Embedded-‘C’.

Designing Interface Circuit for 8051 and Interfacing of External Memory, Programmable Peripheral Interface (8255), Universal Synchronous Asynchronous Receiver Transmitter (8251), Key Board/Display Controller (8279), DMA Controller (8257), Interrupt Controller (8259), ADC (0808/0809), DAC (0800), LCD, 7 Segment Display, Temperature Sensor, Stepper Motor.

EXPERIMENT LIST:

Part – A: Assembly language

1. Write an Assembly Language Program (ALP) to copy a block of 10 bytes of data from RAM locations starting at 10h to RAM locations starting at 20h.
2. Write an ALP Program to find the frequency of square wave generated on any pin.
3. Write an ALP Program to generate a square wave of 50 Hz frequency on any pin using interrupt for timer.
4. Write an ALP Program to connect INT 1 pin to a switch that is normally high whenever it goes low LED should turn ON which is connected to P1.2 & LED is normally OFF. LED should be ON as long as switch is pressed.

Part – B: Embedded ‘C’

1. To develop and execute Embedded-‘C’ program to output data on the port lines of the Microcontroller 8051. Verify the result through LED.
2. To develop and execute Embedded-‘C’ for arithmetic operation (Addition, Subtraction, Multiplication & Division) for the Microcontroller 8051.
3. To develop and execute Embedded-‘C’ program for demonstrating input and output operations using keyboard interface for the Microcontroller 8051.
4. To develop and execute Embedded-‘C’ program to interface 7 segments LED display to the Microcontroller 8051
5. To develop and execute Embedded-‘C’ program to generate square wave on port lines of Port 1 of the Microcontroller 8051.
6. To develop and execute Embedded-‘C’ program for demonstrating logical operations performed by the Microcontroller 8051.
7. To develop and execute Embedded-‘C’ program to interface 16X2 LCD display to the Microcontroller 8051
8. To develop and execute Embedded-‘C’ program to demonstrate serial communication, using RS-232C standard, for the Microcontroller 8051.
9. To develop and execute Embedded-‘C’ program to interface stepper motor to the Microcontroller 8051
10. To develop and execute Embedded-‘C’ program to interface ADC 0800 to the Microcontroller 8051
11. To develop and execute Embedded-‘C’ program to interface DAC 0808/0809 to the Microcontroller 8051
12. To develop and execute Embedded-‘C’ program to interface relays to the Microcontroller 8051.
13. To develop and execute Embedded-‘C’ program to interface 4*4 matrix keyboard to the Microcontroller 8051
14. To develop and execute Embedded-‘C’ program to output the result of addition of contents of Registers R0 and R1 on all four ports for the Microcontroller 8051.
15. Assume 50 Hz. Frequency is connected to I/P P3.4 Write an Embedded-‘C’ program to display count on LCD.

RECOMMENDED BOOKS:

- **Ali Mazidi**, “The 8051 Microcontroller and Embedded Systems”, 2nd ed., Pearson Education.
- **Raj Kamal**, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education.
- **Michael J. Pont**, “Embedded C”, Pearson Education.
- **Warwick A. Smith**, “Arm Microcontroller Interfacing: Hardware and Software”, Elektor Verlag.
- **Data Sheets of Referred Chips**



PD-105 MEASUREMENT AND DISPLAY DEVICES

Overview of Instrumentation System, Units and Standards.

Analog & Digital Voltmeter, Study and applications of Oscilloscope, Function Generators, Signal Generators etc.

Storage and Display Devices: Necessity of Recorders, Recording Requirements, Graphic Recorders, Strip Chart Recorders, Magnetic Tape Recorders, Digital Tape Recorders, Digital Plotters and Printers, Electronic Indicating Instruments, Seven Segment display, Alpha-Numeric Display, CRT display, LED, LCD and Dot Matrix Display.

Transducers and DATA Acquisition Systems: Strain Gauge, LVDT, Thermocouple, Piezoelectric, Crystal and Photoelectric Transducers A/D, D/A converters, Smart sensors and their Applications, Data Acquisition and SCADA Systems.

EXPERIMENT LIST:

1. Determination of frequency & phase angle using C.R.O.
2. To find the Q of a coil using LCR-Q meter.
3. To determine output characteristic of a LVDT and determine its sensitivity.
4. Study characteristics of temperature transducer like Thermocouple, Thermistor and RTD with implementation of small project using signal conditioning circuit.
5. Study characteristics of Light transducer like Photovoltaic cell, Phototransistor and Pin Photodiode with implementation of small project using signal conditioning circuit.
6. To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
7. To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.
8. To study the operation of an A.C. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.
9. To study a stepper motor and control its direction speed and number of steps with the help of a microprocessor.

RECOMMENDED BOOKS:

- **William David Cooper & Albert D. Helfrick**, “Modern electronic instrumentation and measurement techniques”, Prentice Hall
- **K. SAWHNEY**, “Electrical and Electronic Measurements and Instrumentation”.
- **D.V.S. Moorthy**, “Transducers and Instrumentation”, Prentice Hall of India Pvt. Ltd.
- **David A. Bell**, “Electronic Instrumentation and Measurements”, Oxford University Press.
- **Patranabis**, “Principles of Electronic Instrumentation”, Prentice Hall.
- **Carr**, “Element of Electronic Instrumentation & Measurement”, Pearson Education, 1996.
- **White Papers and Data Sheets of referred manufactures Devices and Equipment’s**



PD-201 REAL TIME EMBEDDED SYSTEM DESIGN

Real Time Embedded System: Definition, Requirement and Applications, RTOS, Advance Technologies used in Real Time Embedded Systems, Comparison of 8/16/32/64 Bit Microcontroller, Hardware/Software Co-Design Concept, Features that make ARM Microcontroller the most Popular.

Real Time Operating System: Need, Characteristics and Comparison with DeskTop OS, Kernel Architecture, Threads, Process, Task, Data Structure, Multitasking, Scheduler, Context Switching, Critical Section, Resource Sharing, Interrupt and Priority Handling, Commercial (VxWork, WinCE) and Non Commercial (RT-Linux, FreeRTOS) RTOS, RTOS in Real Time Embedded System with Example.

ARM-7 (32-Bit) Microcontroller : History, Block Diagram, Architecture, Pin Details and its Operation, Evolution of ARM Pipeline, 3-Stage Pipeline (ARM-7 TDMI), 5-Stage Pipeline (ARM-9 TDMI), 6-Stage Pipeline (ARM-10 TDMI), 8-Stage Pipeline (ARM-11 TDMI), ARM Processor Core, Instruction Set Architecture, Registers Mode of Operation, ARM Registers in Different Modes, Data and Instruction Set Types, Little Endian Vs Big Endian, Data Transfer, Thumb Instruction, ARM Decompressor, Interrupts and Exception Handling in ARM-7, ARM-7 Vector Table, Issues Related to Exception, Serial-Parallel Interface using Programming Practices using ARM-7 in Assembly and Embedded-C.

Real World Interfacing with 8051 :Designing Interface Circuit for ARM-7 and Interfacing of External Memory, Universal Synchronous Asynchronous Receiver Transmitter (8251), Key Board/Display Controller (8279), DMA Controller (8257), Interrupt Controller (8259), ADC (0808/0809), DAC (0800), LCD, 7 Segment Display, Temperature Sensor, Stepper Motor, USB and Blue-Tooth Devices.

Design tradeoffs due to thermal considerations and Effects of EMI/EMC and ESD.

EXPERIMENT LIST:

Part – A: Assembly language

1. Write an ALP Program to fetch data from register for performing all Atrithmatical and Logical Operations.
2. Using any RTOS and Embedded-C write a Program for Performing Addition, Subtraction, Division and Multiplication where, Division has highest priority followed by Subtraction, Addition and Multiplication.

Part – B: Embedded ‘C’

1. To develop and execute Embedded-‘C’ program to output data on the port lines of the Microcontroller ARM-7. Verify the result through LED.
2. To develop and execute Embedded-‘C’ for arithmetic operation (Addition, Subtraction, Multiplication & Division) for ARM-7.
3. To develop and execute Embedded-‘C’ program for demonstrating input and output operations using keyboard interface for ARM-7.

4. To develop and execute Embedded-‘C’ program to interface 7 segments LED display to ARM-7.
5. To develop and execute Embedded-‘C’ program to interface 16X2 LCD display to ARM-7.
6. To develop and execute Embedded-‘C’ program to demonstrate Serial-Parallel/USB/ Blue-Tooth Interface for controlling any Peripheral devices using ARM-7.
7. To develop and execute Embedded-‘C’ program to interface stepper motor to ARM-7.
8. To develop and execute Embedded-‘C’ program to interface ADC 0800 to ARM-7.
9. To develop and execute Embedded-‘C’ program to interface DAC 0808/0809 to ARM-7.
10. To develop and execute Embedded-‘C’ program to interface relays to ARM-7.
11. To develop and execute Embedded-‘C’ program to interface 4*4 Matrix Keyboard to the ARM-7.
12. Assume 50 Hz. Frequency is connected to any I/P Pin, write an Embedded-‘C’ program to display count on LCD.

RECOMMENDED BOOKS:

- **Steve Furber**, “Arm System-On-Chip Architecture”, 2nd ed., Pearson Education.
- **Andrew Sloss, Dominic Symes & Chris Wright**, “ARM System Developer’s Guide: Designing and Optimizing System Software”, Morgan Kaufmann.
- **Michael J. Pont**, “Embedded C”, Addison-Wesley.
- **Frankvahid & Tony Givargis**, “Embedded System Design- A unified Hardware/software Introduction”, Wiley India.
- **David E Simon**, “An embedded software primer”, Pearson Education Asia.
- **J.W. Valvano**, "Embedded Microcomputer System: Real Time Interfacing", Cengage Learning.
- **Jack Ganssle**, “The Art of Designing Embedded Systems”, Newnes, 1999.
- **White Papers and Data Sheets of referred manufactures Devices and Equipment’s**



PD-202 MANUFACTURING TECHNOLOGY

Manufacturing Process: Overview, Manufacturing Methodology, Anatomy of Manufacturing Process, Advances in Manufacturing Process and their Applications.

PCB Design: Overview of PCB Design, Guidelines, General Considerations for PCB Layout, Artwork & Stencil making, Photo Printing, Screen Printing, Emerging PCB Technology Trends, Overview of Design Rules for Analog, Digital Circuit and Power Circuit PCB, Application of Heat Sink Concepts. Insertion of components, placement of components. Learning CAD for PCB Design for single layer, double sides, Multilayers, HDI, Metal Clad, MIL Specs. Gerber Data. CAM systems, Photo plotting, Exposure, CNC Drilling, Plating, Developing, etching, stripping, Multilayer Pressing, Innerlayer etching, Photo Imageable Solder Masking, Hot Air Levelling, Gold plating, Flying Probe testing, Bare Board testing, AOI(Automatic Optical Inspection) PCB Repairs & testing. Laser machines for making 3D circuits, Plastic welding, Prototyping fine circuits. Prototype Producing PCB & Assembled Cards for Product designing.

Interconnection Techniques: Elements of Interconnection, Wires, Cables, Connectors, Termination Methods. Maintainability and Serviceability Considerations: Electrical, Mechanical and other Aspects. Application & types of Flux, Solder Paste, Measurement of paste height.

Soldering-Wave Soldering, Reflow, Vapour phasing, Selective Soldering, Lead free soldering.

Cleaning-Cleaning of PCB, Stencils, assembled PCB cards, cleaning media, vapour cleaning, ultrasonic cleaning, Plasma cleaning, Inspection by X-ray & optical methods.

EMI Reduction Technique: Occurrence of Electro Magnetic Interference (EMI), Electromagnetic Compatibility (EMC), Safety Ground, Grounding Schemes, Differences between Analog and Digital Ground, Shielding Techniques, Line Impedance Stabilization Network (LISN), Conducted Noises-Common Mode Noises (CM), Differential Mode Noises (DM), EMI filter Design.

Test & Measurements: Processes Component testing, lead forming, EMC, Vibration, Shock, mechanical strengths, Incircuit testing, Functional testing, Programming, Protection - Conformal coating.

EXPERIMENT LIST:

1. Development of Single Sided PCB for Power Supply Design.
2. Study of Types of PCBs and Technology Development in PCB Designing

3. Study of Fault Diagnosis in PCB
4. PCB Design using PCB Designing Software for Power Supply
5. To learn about the Discrete & SMD components.
6. To learn various packages in which components are available.
7. To have facility to replace the components and PCB circuits with Prototyping making PCB with dry process.
8. Designing & making prototype
9. Design for manufacturability.
10. Function Testing Hand soldering Tools: type of Soldering Stations, Soldering tools, repair tools, pullers, pliers, renches, Power of these tools.

RECOMMENDED BOOKS:

- **Walter C Bosschard**, “PCB design & Technology”, McGraw Hill, New Delhi.
- **R. S. Khandpur**, “Printed Circuit Boards: Design, Fabrication, Assembly and Testing”, Tata Mc Graw Hill Book Co.
- **Avram Bar, Cohen & Allan Craus**, “Thermal Analysis and Control of Electronic Equipment”, Mc Graw Hill, Hemisphere Pub. Co., New York, 1983.
- **Harper**, “Handbook of Electronic Packaging”, Mc Graw Hill, New York, 1979.
- **Keith Brindley**, “Electronic Assembly handbook”, Newnes.
- **Ronald A. Reis**, “Electronic Project Design and Fabrication”, Prentice Hall.
- **Tim Williams**, EMC for Product Designers, 4th ed., Newnes.
- **Ott H.W.**, “Noise Reduction Techniques in Electronic Systems”, 2nd ed., Jhon Wiely and Sons, New York, 1988.



PD-203 ELECTRONIC PRODUCT DESIGN

Overview of Electronic Product Design, Top-Down and Bottom-Up Approach considering Power Supply Design as an example, Electronic Product Design Elements, Principles, Process and Design Methodology, Anatomy of Design Process.

Ergonomics and Aesthetics in Electronic Product Design :Ergonomic Definition with Example, Ergonomic issues in Designing Electronic Products, Design of Controls and Display w.r.t. Ergonomic Consideration, Aesthetics Definition with Example, Aesthetics issues in Designing Electronic Products, Design of Controls and Display w.r.t. Aesthetics Consideration, Composite (Ergonomic and Aesthetics) Design Consideration.

Control Panel Design: Types of Controls, Design and Organization of Control Panel, Engineering Considerations, Layout of Components, Selection of Materials, Sheet metals and plastic, Processes and Surface Finishing Control Mountings Engineering Considerations, Structural Design and Control Cabinets Fabrication.

Computer Aided design : Introduction to Computer Aided Design, Applications and Examples, Finite Element Methods (FEM) and Analysis, Techniques for Surface Modelling, Rendering and Shading, Sources of New Ideas, Creativity Techniques, Form factor, Shape, Colour, Graphics etc.

Thermal Design Consideration : Thermal management of electronic equipment, Thermal design considerations, Component level, board level, system level, Fans and system operating characteristics, Heat Sink design.

EXPERIMENT LIST:

1. Prototype Electronic Product Design and Development for,
 - a. Power Supply Design
 - b. Traffic Light Controller Design
2. Using Hand Made Model, Software Packages etc.

RECOMMENDED BOOKS:

- **Ralph Remsburg**, “Advanced Thermal Design of Electronic Equipment”, Springer
- **V.S.Bagad**, “Electronic Product Design”, Technical Publications.
- **A. K. Chitale, R. C. Gupta**, “Product Design and Manufacturing”, PHI Learning Pvt. Ltd.
- **Merrill L. Mingos**, “Electronic Materials Handbook: Packaging”, ASM International.
- **Dave Mawson & Paul Bell**, “Electronic Products”, Thames.
- **David Pye**, “The nature and aesthetics of design”, A&C Black.
- **Dave S. Steinberg**, “Cooling techniques for electronic equipment”, Wiley, 1991
- **David J. Osborne**, “Ergonomics at work”, Wiley, 1995.

- **Scott A.W.**, “Cooling of Electronic Equipment”, Wiley, 1971.
- **Ernest Paul DeGarmo, J. T. Black, Ronald A. Kohser** “Materials and Processes in Manufacturing”, John Wiley & Sons.
- **C.H. Flurschiem**, “Industrial Design in Engineering Design”, Design Council London and Springer Verlag, 1993.
- **James M. Gere, Barry J. Goodno**, Mechanics of Materials, Cengage Learning



PD-204 RELIABILITY OF ELECTRONIC EQUIPMENT

Introduction to concepts of reliability, nature of reliability problems in electronic equipment, review of probability theory, random variables and probability distributions, functions of random variables, overview of commercial, industrial and mill space grade components.

System Reliability :Introduction, series configuration, Parallel Configuration, Mixed Configuration, Methods of Solving Complex Systems, Mean Time to Failure (MTTF) and Mean Time between Failure (MTBF) of Systems.

Maintainability, Availability and Fault Tree Analysis: Introduction, Maintainability, Availability Concepts, System Downtime, Mean time to Repair (MTTR), Reliability and Maintainability Trade Off, Optimization Approaches, System Safety Analysis, Failure Modes and Effects Analysis, Fault Tree Analysis- Concepts and Procedures, Rules for Fault Tree Construction, Reliability Calculation through Fault Tree

Reliability Improvement and Prediction : Introduction, Improvement of Components, Redundancy, element Redundancy, Unit Redundancy, Standby Redundancy, Optimization, Reliability Cost Trade – Off, Introduction to reliability Prediction, Similar Equipment Techniques, Similar Complexity Techniques, Similar Function Techniques, Part Count Techniques, Part Stress Analysis Techniques, Worst Case Design and De-Rating,

Patent and Intellectual Property Rights: Design for Manufacturing (DFM), Prototyping, Robust Design, Patents and Intellectual property, Product Development Economics, Managing Product Development Projects, Product Compliance to standards, Product Quality Control, Concept of Star Ratings, BEE certifications in India.

EXPERIMENT LIST:

Finding out Reliability from Datasheet for Following Component and Parameters:

- i. Any type and Rating of Resistance
- ii. Any type and Rating Capacitance
- iii. Any type and Rating Diode
- iv. Any type and Rating Transistor

RECOMMENDED BOOKS:

- **Military Handbook**, Electronic Reliability Design Handbook, Department of Defence, USA
- **Eugene R. Hnatek**, “Practical Reliability of Electronic Equipment and Products”, CRC Press.
- **Patrick O'Connor & Andre Kleyne**, “Practical Reliability Engineering”, 5th ed., Wiley Publication.
- **Bazovsky Igor**, “Reliability Theory and Practice”, Dover Publications.

- **Titu-Marius I. Băjenescu, Marius I. Bâzu**, “Component Reliability for Electronic Systems”, Artech House
- **Sridhar Canumalla & Puligandla Viswanadham**, “Portable Consumer Electronics: Packaging, Materials and Reliability”, PennWell Books.
- **Milton Ohring**, “Reliability and Failure of Electronic Materials and Devices”, Academic Press.
- **Dale H. Besterfield**, “Total Quality Management”, 3rd ed., Pearson Education.
- **L. Suganthi & A. Samue**, “Total Quality Management”, PHI Learning Pvt. Ltd
- **Karl T Ulrich & Steven D Eppinger**, “Product Design & Development”, 3rd ed., Tata Mc Graw Hill Publication.
- **Fnqua Norman B**, “Reliability Engineering for Electronics Design” Marcel Dekkar Inc., NewYork, 1987
- **Cluley, J.C.** “Electronic Equipment Reliability”, Macmillan Press, 1981.
- **Data Sheet from Respective Electronic Component Manufacturer**



PD-207 PROJECT & DISSERTATION:

The students will complete their Project & dissertation work and submit copies of the Design and Prototype Working Model with Project report to the centre as per its procedures. The Internal and External Examiners appointed by the University/ Centre will evaluate the same through a Viva-voce examination & demonstration.