Syllabus of PET for Electronics

Section A: Research Methodology

Unit I: Research Fundamentals:

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research

Research categories: Basic research, Applied research-problem solving research and problem oriented research, Some other types of research-evaluation research; performance monitoring research; total quality management (TQM), Types of research, Features of good research study, Entering into the research, Qualities of a good researcher, The research process: Identifying the problem, developing research strategy, collection of data, analysis of collected data, preparation of research report, organization of research report

Unit II: Defining Research Problems:

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem, Formulation of the problems: steps involved in defining a problem, formulation of the problems,

Unit III: Hypothesis Formulation:

Formulation of hypothesis: Concept of hypothesis, hypothesis testing , Developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis of in decision making.

Unit IV: Methods and Techniques of Data Collection:

Types of data: primary and secondary, distinction between primary data and secondary data, Data collection procedure for primary data: planning the study, modes of primary data collections, primary data observation process, primary data experimentation methods, primary data questionaries' techniques, limitations of primary data collections, different types of study through primary data; Methods for secondary data collections: secondary data may either be published data or unpublished data, sources of unpublished data, secondary data- internal, secondary data-external.

Unit V: Research Report and Proposal Writing:

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper.

References:

1. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta (International Book House Pvt Ltd (2013)
2. Basic Research Methods-Gerard Guthrie
3. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer
4. Research Methodology-methods and techniques- C. R. Kothari
5. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell
6. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar
7. Scientific Writing and Communication- Angellka Hofmann
8. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded- Joshua Schimel
9. Handbook of Scientific Proposal Writing- A.YavuzOruc

Section B: Core Subject

Unit - I: Basic Embedded Systems

8051 Microcontroller: Introduction, Features, Pin diagram, Addressing Modes and Instruction Set, Parallel I/O Ports, Interfacing of (DAC, ADC, LCD, hex keyboard, stepper motor), Interrupts, Timer/Counter, Serial Communication

PIC 16F877 Microcontroller: Introduction, Pin diagram, Reset actions, Oscillator connections, Status register , PCON, Option_reg, PIC 16F8XX program memory, PIC 16F8XX data memory, data EEPROM and Flash program EEPROM, Interrupts in 16F877, I/O Ports, Timer Interfacing of **(** LED, push buttons, relays , 7 segment display, LCD, ADC and DAC)

References:

1. 8051 Microcontroller – V. Udayashankara, M.S. Mallikarjunswamy , Tata McGraw-Hill
2. The 8051 Microcontroller and Embedded systems – M.A. Mazadi, J.G.Mazadi, R.D. McKinlay- Second Edition –Pearson3
3. Microcontrollers [Theory and Applications] – Ajay Deshmukh, TMH, New Delhi, 2009

Unit - II: AVR and ARM Controllers

AVR Microcontroller (ATmega32): Features, Architecture, Pin connections, Fuse bits, Instruction Set, Timer/Counter

ARM Embedded Systems: RISC Design Philosophy, ARM Design Philosophy, Embedded System Hardware, Embedded System Software

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families

Introduction to ARM Instruction Set: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, Conditional Execution

Introduction to Thumb Instruction Set: Thumb Register Usage, ARM-Thumb Interworking, Other Branch Instructions, Data Processing Instructions, Single-Register Load-Store Instructions, Multiple-Register Load- Store Instructions, Stack Instructions, Software Interrupt Instruction

References:

1. AVR Microcontroller and Embedded Systems using Assembly and C – Muhammad Ali Mazidi, Samad Naimi, Sepehr Naimi, Pearson 2014
2. ARM System Developer's Guide: Designing and Optimizing System Software – Andrew N. SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier
3. ARM Assembly Language: Fundamentals and Techniques – William Hohl, CRC Press

Unit - III: Sensors, Signal Conditioning and PC Based Instrumentation

Transducers **(**Resistive, Inductive, Capacitive, Thermoelectric, Piezoelectric, Magnetostictive, Hall Effect, Electromechanical, Photoelectric, Digital, Electrochemical), Components of Analog Signal Conditioning, Operational Amplifier, Operational Amplifier Circuits in Instrumentation, Components of Digital Signal Conditioning, Transducer Signal Conditioning Design Bio-electric Signals and Electrodes, Physiological Transducers, Principles of Data Acquisition, Data Acquisition using Serial Interface, Data acquisition using USB and IEEE, Networked Data Acquisition

Reference:

1. Transducers and Instrumentation, 2nd Edition- D.V.S.Murty, PHI, 2010
2. Industrial Electronics – Terry Bartelt, DELMAR Cengage learning, 2006
3. Electronics Measurements and Instrumentation By K. Lal Kishore, PEARSON
4. Op-Amps and Linear Integrated circuits --- Ramakant .A.Gaikwad
5. Electronic Instrumentation – H.S.Kalsi
6. A Course in Electrical and Electronics Measurements and Instrumentaion By A. K. Sawhney, DHANPAT RAI & CO.
7. Handbook of Bio-medical Instrumentation – R.S. Khandpur, TMH, New Delhi
8. PC-Based Instrumentation – N. Mathivanan –PHI

Unit - IV: Industrial Monitoring, Control and Automation

Temperature Measurement, Flow Measurement, Pressure Measurement, Level Measurement, Introduction to Power Switching Devices, Phase Controlled Rectifiers, Inverters, Introduction of UPS, DC-DC Converters, AC voltage controllers, Electric Motors: DC motors, AC motors, Servo motors, DC Drives, AC Drives

Introduction to Programmable Logic Controllers

Industrial Motor Control circuits, Relay Ladder Logic Circuits, building a Ladder Diagram, Motor Control Starter Circuit, Rack Assembly, Power Supply, PLC Programming Unit, Input / Output Sections, Processor Unit, Addressing, Relationship of Data File Addresses to I/O Modules

Fundamental PLC Programming

PLC Program Execution, Ladder Diagram programming Language, Ladder Diagram Programming, Relay logic Instructions, Timer Instructions, Counter Instructions, Data Manipulation Instructions, Arithmetic Operations, Writing a Program.

Advanced Programming, PLC Interfacing and Troubleshooting

Jump Commands, Data Manipulations, Discrete Input / Output Modules, Troubleshooting I / O Interfaces, Analog Input and Output Signals, Special purpose Modules, Troubleshooting Programmable Controllers

Reference:

1. A Course in Electrical and Electronics Measurements and Instrumentaion By A. K. Sawhney, DHANPAT RAI & CO.

2. Power Electronic – P. S. Bimbhra, Khanna Publishers
3. NED MOHAN TORE. M. UNDELAND & WILLIAM. P. ROBBINS: "Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons 2003
4. Industrial Electronics- Circuits, Instruments and Control Techniques – Terry Bartelt, DELMAR, Cengage Learning India Pvt. Ltd.Delhi, 2009

Unit- V: Smart Fusion and Mixed Signal SoC System Design

Smart Fusion Technology: Concept of fusion and smart fusion technology, Anti-fuse, Static RAM, EPROM and EEPROM, Technologies Logic Modules 1, 2, 3. Shannons Expansion Theorem, Multiplexer Logic as Function Generator, ASIC Logic cell, Types of ASIC, ASIC Design flow, Combinational, Sequential, Data paths, I/O cells, Cell Compilers

Architecture of Smart Fusion device: Introduction to Customizable System-on-Chip (CSoC), Architecture of Smart Fusion Device, Block diagram of Smart Fusion A2F200M3F, Microcontroller Sub System (MSS), Microcontroller Core, Programmable Analog Block, Programmable Digital Block, Programmable Communication Interfaces, FPGA fabric: Clocking Resources, SRAM , User I/Os, Banks and Standards, Review of evaluation board of Micro-semi CSoC

Programmable Analog: Features of programmable Analog Compute Engine (ACE), Analog Front End (AFE), Features of ADC, DAC, ABPS, Current Monitor, Temperature Monitor, High-Speed Comparator, Development tools for Microsemi smart fusion device. Re-configurability and dynamic re-configurability, Concept of hardware software co-design, Design tools for smart fusion devices, Design flow, Libero SoC, Configuration of MSS, Simplify model, Sim Softconsole.

Design of system for Temperature measurement, Humidity Measurement, Mobile Communication, Core of 8051 microcontroller

Mixed Signal SoC Design: Mixed-Signal embedded SoC architectures, Programmable Digital Subsystem, Continuous Time analog building blocks, Switched-Capacitor analog building blocks, Delta-Sigma Analog to digital converters, Design of Mixed signal based system

Reference:

1. Datasheet of SmartFusion Customizable System-on-Chip
2. SmartFusion Microcontroller Subsystem Users Guide
3. SmartFusion Programmable Analog Users Guide,
4. Introduction to Mixed signal, Embedded Design A. N. Doboli and E. H Currie Cypress semiconductor corporation (2007)
5. Designers Guide to the Cypress PSoC by Robert Ashby Elsevier
6. CMOS Circuit design, Layout and Simulation, R. J. Baker, WSE, Willey (2009)