Structure of T.E(2003 Course) :-

Detail T. E. Electronic Syllabus

TE (E&TC / Electronics Engineering)

Semester - I

Structure of T.E.(E&TC)2003 Course									
Sub. No.	Subjects	Teaching Scheme			Examination Scheme				
		Lecture	Tutori.	Practi.	TW	TH	PR	OR	
Semester I									
304181	Digital Design & Computer Organization	4	-	-	-	100	-	-	
304182	Analog Integrated circuits- Design & application	4	-	-	-	100	-	-	
304183	Digital Communication	4	-	2	25	100	-	50	
304184	Microprocessor, Microcontrollers & Applications	4	-	-	-	100	-	-	
304185	Mechatronics	3	-	2	25	100	-	-	
304186	Electronics Lab – I *	-	-	4	50	-	50	-	
304187	Electronic Design Workshop **	-	-	2	-	-	-	50	
Total		19	-	10	100	500	50	100	

Semester - II

Structure of T.E.(E&TC)2003 Course									
Sub. No.	Subjects	Teaching Scheme			Examination Scheme				
		Lecture	Tutori.	Practi.	TW	TH	PR	OR	
Semester I									
304188	Advanced	4	-	-	-	100	-	-	

	Microprocessors									
304189	Power Electronics	4	-	-		-	100	-	-	
304190	Digital Signal Processing	4	-	-		-	100	-	-	
3041891	Electromagnetic waves & Radiating systems	3	-	-		-	100	-	-	
304192	Information theory & coding techniques	4	-	-		-	100	-	-	
304193	Electronics Lab – II *	-	-	4		50	-	50	-	
304194	Signal Processing & Communication Lab **	-	-	4		25	-	-	50	
304195	Electronic system design & Mini project ***	-	-	2		25			50	
Total		19	-	10		100	500	50	100	

Th: Theory Tw: Term Work Pr: Practical Or: Oral

Digital Design & Computer Organization

Teaching Scheme Examination scheme

Lectures / Week : 4 Hrs. Paper : 100 Marks

UNIT I - Sequential Circuit Design:

Synchronous and asynchronous FSM design, Basic design steps, State encoding techniques, VHDL coding of state machines, Analysis of sequential circuits, Algorithmic state machine (ASM) charts.

UNIT II - HDL:

Introduction to HDL, VHDL, Library, Entity, Architecture, Modeling styles, Signals and variables, Sequential and concurrent statements, Synthesis and simulation concepts, implementation of logic function.

UNIT III - ALU Design:

Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication – Booth's algorithm, Fast multiplication – Bit pair recoding of multipliers, Carry save addition of summands Integer division, Floating-point numbers and operation, IEEE standards for floating point numbers, Arithmetic operations on floating point numbers, Guard bits and truncation, Implementing floating point operation.

UNIT IV - CPU Design:

Memory operations, Instruction and instruction sequencing, Addressing modes, Assembly language, Basic input/output operations, Stacks and queues, Subroutines, Execution of a complete instruction, Multiple bus organization.

UNIT V - Input/ Output Organization:

Accessing I/O devices, Interrupts, Direct memory access, Buses, Interface circuits

UNIT VI - Memory Organization:

Semiconductor RAM memory, Read only memory, Speed, Size and cost, Cache memories, Performance considerations, Virtual memories, Memory management requirements, Secondary storage.

Text Books:

1. Stephen Brown, Zvonko Vranesic “Fundamentals of digital logic with VHDL design”

2. Hamacher, Vranesic, Zaky, “Computer Organization”, Fifth Edition

Reference Books:

1. Fletcher, “Principles of Digital design”

2. Sudhakar Yalaman Chili, “Introductory VHDL from Simulation to Synthesis”

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ANALOG INTEGRATED CIRCUITS – DESIGN & APPLICATIONS

Teaching Scheme **Examination scheme**

Lectures / week: 4 Hrs. **Paper: 100 Marks**

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UNIT I - Op-Amp Fundamentals:

Block diagram of Op-amp (Basic building blocks) -

Differential amplifier fundamentals – Fundamentals, Types, DC and AC analysis, Current sources, Current mirrors, Active load, Differential to single ended conversion.

Additional gain stage. DC level shifter. Output stage. An overview of different types of op-amp, their peculiarities and application areas

General purpose, Precision, Instrumentation, Isolation, Power, Comparators, Fast settling time, Fabrication based classification

Ideal Op-amp parameters open loop and closed loop, Inverting and Non-inverting configurations, Concept of virtual short and virtual grounds.

Non ideal (AC and DC) Op-amp behavior and its effect on performance.

UNIT II - Op-Amp Applications:

Voltage follower, Summing amplifier, Difference amplifier, its limitations in precision differential measurements

Offset nulling techniques, Drift parameters and their effect, closed loop Stability, Power supply considerations–Single power supply operation.

V to I and I to V converter

Instrumentation amplifier and applications (Bridge based circuit)

Grounding and shielding techniques

Integrator, Practical considerations

Differentiators, Practical considerations

UNIT III - **Non-linear Applications of Op-Amp:**

Comparators, Differences between Op-amp output circuits and comparators output circuit (rail-to-rail concept).

Limitations of Op-amp as Comparator, Schmitt trigger, Comparator IC such as LM339, Bandwidth and slew rate limitations.
Precision rectifiers, Peak detector, Sample and hold circuit.

Clipper and clamper.

UNIT IV - **Signal Generators**

Sine wave generation

Multivibrators

Monolithic timers (self study)

Triangular wave generators

Saw tooth generators

V to F and F to V converters.

UNIT V - **Active Filter Design:**

Introduction, Filter types, Advantages of active filters, Filter order and poles, Filter class- Butterworth, Chebyshev, Bessel, Elliptic.

Realizing practical filters -

Sallen and Key VCVS filter

Sallen and Key low pass filter

Sallen and Key high pass filter (self study)

Butterworth filters

Low pass filter specifications & design from specifications (up to 4^{th} order)

w_p, w_s, a_{min}, $a_{max,}$ Sallen and Key circuit I, II, III

Band pass filter design and frequency transformations -

Low pass filter to band pass filter

Low pass filter to high pass filter

Low pass filter to band stop filter

UNIT VI - **Non-linear Applications and Phase Locked Loops**

Introduction to Log/Antilog amplifiers and Analog multipliers

Block diagram of PLL -

Phase Detector, LPF, VCO

Block diagram of PLL IC 565

Definitions-free running frequencies, lock range, capture range, pull in time

Transfer characteristics of PLL

Applications of PLL - Frequency synthesizer, FM demodulator, AM demodulator, FSK demodulator

List of Practical:

1. Study of Non-ideal parameters with general purpose (741C) and precision (OP-07) op-amps.
2. Op-amp parameters measurement -Offset voltage, Bias current, CMRR, Slew rate, Open loop gain (Experimental chassis to be provided with test results).
3. Op-amp applications-I: Integrator, Differentiators, Instrumentation

   (Interface with Bridge), Compare with difference amplifier, Single ended output and differential output.
4. Op-amp applications-II: Comparator (LM 339), Schmitt trigger.
5. Design, Simulate, Build and Test Active filters.
6. To study the operation of IC 565 as PLL.
7. Design, Build and Test a Square wave generator using op-amp.
8. Study of Precision rectifier.

Note:- Verify theoretical/practical and simulate the results.

Use PSPICE for simulation.

A) Text Books:

1. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, TMH, Third Edition

2. G.B.Clayton, “Operational Amplifiers”, International Edition

B) Reference Books:

1. Coughlin, Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, PHI, Fourth Edition.

2. D.Roy Choudhary, Shail Jain, “Linear Integrated Circuits”, New Age International.

3. Ramakant Gaikwad, “OP-AMP and Integrated Circuits”, PHI.

4. Govind Daryanani, “Principles of Active Network Synthesis and Design”, John Wiley and Sons.

5. M.E.Van Valkenburg, “Analog Filter Design”, PHI.

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DIGITAL COMMUNICATION

Teaching scheme Examination Scheme

Lectures / Week: 4 Hrs Paper: 100 Marks

Practicals / Week: 2 Hrs Term-Work: 25 Marks Oral: 50 Marks

UNIT-I: Random Processes:

Introduction, Mathematical definition of Random process, Stationary process, Mean, Correlation, Covariance function, Ergodic process, transmisson of random process through LTI filter, Gaussian Process, Power spectral density, Noise, Narrow band noise. Band limited and time limited signals, Narrow band signals and systems, Sampling theorem in frequency domain and time domain, Nyquist criteria, Reconstruction using interpolation filters, Ideal, Natural, Flat samples, Aliasing, Aperture effect.

UNIT-II: Waveform Coding:

Pulse code modulation: PCM generation and reconstruction, Quantization noise, Non uniform quantization and companding. PCM with noise: Decoding noise, Error Threshold, Comparison of PCM Vs analog modulation.

Delta modulation and predictive coding: Delta modulation, Delta-Sigma modulation, Adaptive Delta modulation, Differential PCM, LPC speech synthesis. Digital Audio

Recording: CD- recording, CD playback. Standards (ITU)-Voice Encoding Standards and Multiplexing standards.

UNIT-III: Performance In The Presence of Noise and Line codes:
Performance in the presence of noise of PCM, DPCM, DM, ADM. Digital multiplexers (Synchronous, asynchronous, Quasi-synchronous) Data formats-Unipolar and Polar NRZ, RZ, Bipolar (AMI), Manchester, Synchronisation –Bit and Frame, Scrambling-Unscrambling.

UNIT-IV: Digital continuous wave modulation:

Introduction, Binary phase shift keying, Differential phase shift keying, Differentially – Encoded PSK, Quadrature phase shift keying, M-ary PSK, Quadrature Amplitude shift keying, Binary frequency shift keying, similarity of BFSK and BPSK, M -Ary FSK, Minimum shift keying (MSK), GMSK.

UNIT-V: Detection and Performance Analysis of Digital Signal:

Base band signal receiver, Probability of error, Optimum filter, White noise-Matched filter, probability of error of matched filter, correlation, FSK, PSK,

Non-coherent detection of FSK, DPSK, QPSK, Calculation of error probability for BPSK & BFSK, Signal space to calculate P_e.

UNIT-VI: Spread Spectrum:
PN sequences, DSSS with coherent BPSK, Signal space representation and Processing

Gain, Probability of error, Frequency hopped Spread Spectrum.Introduction to Multiple

Access Techniques-TDMA, FDMA and CDMA.

Text Books:

1) A.B. Carlson “Communication systems” MGH (4th Edition)
2) Taub Schilling “Principles of Communication Systems” TMH-(2nd Edition)
3) Simon Haykin “ Communication Systems “ WSE (4TH Edition)

Reference Books:

1) Proakis “Digital Communications” MGH (4th Edition)
2) Das, Mullick, Chatterjee “Principles of Digital Communication” New Age International.
3) B. P. Lathi “Modern Digital & Analog communication Systems” Oxford Univ. Press.-(3rd Edition)

LIST OF PRACTICALS:

1. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), Effect of variable sampling rate, filter cutoff, reconstruction of original signal using Interpolation Filter. Aliasing Effect in frequency domain.
2. Companded PCM (using A-law). Plot Quantization curve, calculation of bit rate, Quantization noise measurement and SNR measurement.
3. Study of DM and ADM Techniques, observation of effect of slope overload, Granular Noise and SNR measurement.

4. Generation and reception of QPSK in presence of noise.
5. Generation and reception of FSK in presence of noise.
6. Study of line codes (NRZ, RZ, Polar RZ, Bipolar (AMI), Manchester) and their spectral analysis.
7. Detection of digital base band signal using matched filter in presence of noise.
8. Generation of 6-bit PN sequence & study of spectrum.
9. Generation and Detection of DS-SS coherent BPSK and spectral analysis.

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MICROPROCESSOR, MICRO CONTROLLER

AND APPLICATIONS

Teaching Scheme | Examination scheme

Lectures / week: 4 Hrs. | Paper: 100 Marks

UNIT I –

Introduction to 8-bit architecture, Memory and I/O interfacing, Concept of programmable peripheral interface (8255), Introduction to software and hardware tools. (Cross assemblers, Logic analysers, Emulators, Simulators)

UNIT II –

8051 architecture, Comparison with microprocessor, Pin diagram, Clock and oscillator

flags, PSW, Stack, Internal memory, External memory, Idle mode, Power down mode, SFR, Counter, Timer, Timer mode, Serial I/O and Interrupt structure.

UNIT III -

Instruction set and programming of 8051.

UNIT IV -

Interfacing to external world, External RAM &ROM, Display [LED/LCD] & Keyboard, ADC& DAC, Memory interfacing, Stepper motor preferably I2C compatible.

UNIT V -

Busses and protocols, RS 232C, RS 485, I2C, SPI, Modbus.

UNIT VI -

Conceptual study of various derivatives of 8051 micro controller such as RD, OTP, AVR containing PWM, RTC timer, EEPROM in system programming, Microprocessor supervisory control and architecture of PIC micro controller

Text Books:

1. **Kenneth Ayala ,"8051 Micro controller" PHI**
2. **Predko ,"Programming and customizing 8051 Micro controller", TMH**

Reference Books:

1. **Gaonkar," Microprocessor architecture" PHI**

2. **Ajay Deshmukh, "Micro controller Theory and application" , TMH**

3. **Mazidi-**

MECHATRONICS

Teaching Scheme	Examination scheme
Lectures: 3 hrs/week	**Paper: 100 Marks**
Practical: 2 Hrs/week	**Term work: 25**
Marks	

UNIT I - Introduction to Mechatronics:
Definition of Mechatronics, Basic Characteristics of measuring device like Static& Dynamic Characteristics as Accuracy Precision ,Resolution, Repeatability, Reproducibility, Drift, Hysteresis, Linearity, Sensitivity, Threshold, Speed of response , Measuring Lag, Fidelity Static Error & Dynamic error calculations.

Scope & Its importance with respect to inter disciplinary approach, Role of electronics in mechatronics, Mechatronics system design approach with reference to robotics & Automation Printer & Elevator systems (overview)

UNIT II-Overview of Sensors and Transducer & their characteristics, Specifications:

Specifications related to selection criterion for force pressure temperature & motion (Rotary or linear)

Force: Load Cell, Cantilever beam (Design aspect Example)

Pressure: Strain Gauge, Piezoelectric, LVDT

Motion: Rotary & Linear motions, Proximity sensors, Inductive, Capacitive & Magnetic.

Temperature Fiber optic temperature sensors.

Ultrasonic Transducers applications as position, Level, flow Etc.

UNIT III - Signal conditioning & data acquisition & controller:

Use of Wien Bridge, Wheatstone bridge, Instrumentation amplifier (IC based AD 633,AD 522/524) for above sensors & Transducers, Specifications of A/D & D/A converter related to mechatronics applications, Interfacing of inputs & Outputs with Micro controller with (89C series & PIC Micro controller), Interfacing of Sensors with PLC, PLC's selection criterion & their specifications

UNIT IV - Data presentation & data logging system:

Magnetic recorder, Strip- Chart recorder in mechatronics. Block Diagram of typical interface IEEE 488 standard bus, Rs232 slandered, Multichannel data logger (Block Diagram) ,I^2C bus, HART Protocols, Computer based data Acquisition System

UNIT V – Actuators:

Concept of Actuators, Classification of Actuators Pneumatic Hydraulic & Electrical Actuators, Selection criterion of Control valve, & Motors, Single Acting & Double Acting Cylinders

Electro _Pneumatic: Pneumatic Motor, Valves

Electro_ Hydraulic: 3/2valves, 4/2 valves, 5/3 Valves

Electrical actuation System: Selection criteria & Specifications of Stepper motors, Solenoid Valves, Relays & Servomotors

Cables: Power Cable & Signal Cables

UNIT VI - Study different applications of Mechatronics as CASE study:

CASE STUDY 1 : Mechatronics Design of a Coin Counter.

CASE STUDY 2 : Mechatronics Design of a Robotic walking Machine.

CASE STUDY 3 : Strain Gauge /LVDT based Weighing machine.

CASE STUDY 4 : Rotary optical Encoder

CASE STUDY 5 : Skip control of CD player.

Text Books:

1. W. Bolton," Mechatronics Electronic control system in Mechanical & Electrical engineering", Pearson Education, (3 rd Edition)
2. David Alcitore / Michael B. Histand,"Introduction to mechatronics & Measurement systems", Tata McGraw Hill, (2 nd Edition)

Reference Books:

1. N.P.Mahalik,"Macaronics Principles concepts & Applications ", Tata Mc Graw Hill

(2nd Edition)

2. Devdas Shetty, "Mecahatronics Systems Design "

Thomson Publication

3. Rangan, Sarma, Mani,"Instrumentation devices & Systems"

Tata McGraw Hill, (2nd Edition)

LIST OF PRACTICALS (8 Practicals)

Five practicals out of first 6, Any three practicals from practical no 7, 8, 9 & 10

1) Plot the characteristics of Pressure transducer (Strain Gauge/Any pressure sensor)

& Temperature Transducer (Thermocouple, RTD, Thermistors) Check it with suitable applications .Do the confirmation of specifications according to the data sheet.

2) Study of various Electrohydraulic components (ElectroHydraulic trainer Kit & Simulator)

3) Study of various Electropneumatic components. (ElectroPneumatic trainer kit & Simulator)

4) Study of PID controller (Pic Micro controller based systems Design and Simulation) using graphical PID display

5) PLC Programming-Interfacing with proximity sensors, Rotary encoders, Optical Sensors, Limit switches (Application of PLC)

6) Study of Displacement velocity & Acceleration Measurement (Conversion of Non electrical parameter into electrical parameter.)

7) Mechatronics case study of ROBOTICS-operation of pick & place robot including programming in linear /circular mode.

8) Study of Mechatronics system I–Using Components sensors Actutaors, PLC/Micro controller)

9) Study Of Mechatronics system II –Using Components sensors Actutaors, PLC/Micro controller)

10) Study of Mechatronics system III–Using Components sensors Actuators, PLC/Micro controller)

NOTE:

Experiments should be executed using Simulators, Virtual Lab platform such as Lab View.

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ELECTRONICS LAB - I

Teaching Scheme **Examination scheme**

Practicals / Week: 4 Hrs. **Practical: 50 Marks**

Term Work: 50 Marks

List of Experiments for Analog Integrated circuit & applications:

1. Study of Non-ideal parameters with general purpose (741C) and precision (OP-07) op-amps.
2. Op-amp parameters measurement -Offset voltage, Bias current, CMRR, Slew rate, Open loop gain (Experimental chassis to be provided with test results).
3. Op-amp applications-I: Integrator, Differentiators, Instrumentation (Interface with Bridge), Compare with difference amplifier, Single ended output and differential output.
4. Op-amp applications-II: Comparator (LM 339), Schmitt trigger.
5. Design, Simulate, Build and Test Active filters.
6. To study the operation of IC 565 as PLL.
7. Design, Build and Test a Square wave generator using op-amp.
8. Study of Precision rectifier.

Note - Verify theoretical/practical and simulate the results.

Use suitable simulation software.

List of Experiments for Microprocessors Micro controller & Applications

1. Executing program using various instruction using simulators
   a. Add / Subtract, Multiply and Divide using internal memory

   b. Executing External memory related instruction e.g. 8255(as a memory map ext

      RAM or external EPROM)

2. Designing mathematical calculator
   a. Add
   b. Subtract
   c. Multiply
   d. Divide
   e. Square

   Using simulator kit

3. Timing diagram of typical target board using DSO and logic analyzer of typical instruction.
4. Creating program using assembler and downloading using EEPROM/Flash programmer small program to flash LED.
5. Interfacing keypad and LCD display and program to detect the key and display on LCD
6. Interfacing 8 bit and 12 bit ADC. Find out average value over 10 readings
7. Interfacing D/A converter
   a. Generating various waveforms
8. Debugger using simulator and emulator
9. Serial communication to PC
10. Controlling motor/stepper motor

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ELECTRONIC DESIGN WORKSHOP

Teaching Scheme
Examination scheme
Practicals / Week: 2Hrs. **Oral: 50 Marks**
Term work: 50 Marks

Assignment to cover following:

A) Title -Design of Linear Regulated Power supply

Scope of design:

1) Design the circuit with given specification.
2) Design of regulated DC power supply.
3) Indicators for over voltage, over current.
4) Input power considerations and protection circuits. (MOVs, EMI filters, Fuses, MCB)
5) Thermal considerations.
6) Verification of each designed circuit using any simulation software. (Printout should be part of submission)

Design specifications

A1) 0 to 30V, 15A

A2) 0 to 30V, 0 to 2A

A3) 0 to +/-12V, 1A

A4) 5V, 2A

A5) 100V, 100mA(using floating regulator)

A6) 0 to 12V, 5A(using programmable regulator with proper step size)

A7)-5V, 0 to 5A

A8) 1A.30Vmax (current source generator) / 30W max, load R

For all the above designs consider mains variation –15% to 10%

O/P ripple voltage <= 0.1% of regulated O/P voltage.

Calculate Sv and ro.

B) FSM, ASM based Digital Design

Design to include:

a) FSM – sequence generator, sequence detector
b) Moore and Mealy machines, state diagram.
c) ASM technique- vending Machine, Lift controller, traffic controller, Washing machine & Micro oven, Automatic bottle filling plant.
d) Implementation – combinational logic in state machine using MSI, LSI devices like multiplexers, decoders, PLDs, ROM, fuse map generation, steps in designing using PAL

B1) FSM design:

a) Sequence generator:

Ex -1) A typical PN sequence generator

2) Six stage MLS counters using shift register (maximum length sequencer)

3) Gray code generator

4) Five bit decimal counter

b) Sequence detectors:

Ex -1) A combinational lock

2) Flag detection in synchronous communications

3) Magnetic code detection/credit, debit card detection / ATM card

B2) ASM design:

a) Automatic controllers in Industrial application:

1) Automatic bottle filling plant

2) Vending machines

b) Automatic controllers in Domestic applications:

1) Washing machine

2) Microwave oven

3) Food processor

C) Analog Filter Design:

Scope of assignments shall be –

a) Second order transfer functions of LP / HP / BP / BS filters

b) Unity gain sallen key, KRC filters realization techniques.

c) Sensitivity analysis

d) Frequency response simulation using softwares like p-SPICE etc.

e) Cascading of filters for higher order filter design

Low Pass Filter tuning:

Part A: Design a second order LPF with cut off frequency f_0=3.4 KHz for the following configuration:

1. Unity gain Sallen & Key configuration with Q=2.
2. Q=0.707 for Butter worth LPF.
3. KRC filter with gain =5 and using equal components.

Part B: Investigate the effect of 1% variation of each component in the program of any 2 of the above circuit.

Part C: Use any simulation software like p-SPICE to visualize the frequency response.

Part D: Comment on-

i. Cascading of filters for 3rd and 4th order.

ii. Other types responses like Chebyshev, Cauer.

High Pass Filter:

Part A: Design a second order HPF with cut off frequency f0= 100 Hz. For the following configurations:

i. Unity gain Sallen Key Configuration with Q=2.

ii. Q=0.707 Butter Worth HPF.

iii. KRC filter with gain =5 and using equal components

Part B, C, and D: Similar as given in LPF with reference to HPF.

Band Pass Filter:

Part A: Design a second order BPF with f0= 1KHZ and BW = 100 Hz using equal Component option. What is its resonance gain.

Part B: Use PSPICE to visualizing the frequency response

Part C: I Comment on Cascading of filter for 3^{rd} and 4^{th} order.

II Other types responses like Chebyshev, Cauer.

Band Stop Filter / Notch Filter:

Part A: Design a Second order notch filter with f0= 60 Hz and BW= 5Hz. What is its low and High Frequency gain.

Part B: Use PSPICE to visualizing the frequency response

Part C: I Comment on Cascading of filter for 3^{rd} and 4^{th} order.

II Other types responses like Chebyshev, Cauer.

D) Micro controller Based Data Acquisition System:

Scope of assignments shall be –

a) Selection of Transducer for given specification

b) Front end analog signal conditioning circuit

c) Selection of suitable A to D converter

d) Selection of Micro controller

e) Output interfacings:

i) Relay

ii) Display (Single LED)

iii) DAC with PWM for analog output

D1. Temperature measurement systems:

Design data acquisition system to measure temperature between 20^0C to 90^0C with resolution of 1^0C and accuracy of 0.5%. The DAS should provide an isolated 4-20mA analog output using PWM-DAC combination. The system should also provide for 230V / 5A potential free NO contact for each of HI and LO alarms. The set point should be variable

Give software scheme for implementation in the form of flowchart

D2. Flow measurement system:

Design a flow measurement system using a ultrasonic flow sensor (transit time effect / Doppler effect) either ‘wetted’ or ‘clamp-on’ type. The proposed system should be able to sense pressure up to _ _ _ bars with a maximum flow velocity of 10 m/s, with a temperature of liquid/slurry not more than 200^0C. Accuracy of 1% should be achieved.

Design front end / i/p ride signal conditioning scheme, select a Micro controller suit to the purpose and

i) Display the flow rate

ii) Transmit data to master unit

iii) Operate valve at min / max threshold with indication (audio/visual) & Hystersis

D3. Level Measurement System:

Design a Level measurement system for non-conducting liquid in a tank of 10m-height using capacitance probe. The level is to be controlled using a control valve supplying the liquid in the tank. The level measured to be transmitted at a distance of 200m and indicated on 3-½ digit LCD. The Micro controller should generate a PWM signal proportional to measure level and trigger alarms if level is less than 1m or more than 9m. the alarm condition should be indicated on front panel by means of bar-graph. The bar-graph should also indicate measured level (on a 20 element bar-graph)

D4. Design a Micro controller based weigh scale using load cell. The maximum weight that the machine can measure is 20Kg. Design signal conditioning system that includes calibration of machine (full scale) and Tare weight (offset) adjustment. Micro controller should be able to communicate data to a PC on RS 232C link and transfer weight information on PC. The measured weight is also to be printed on local printer. The weighing machine has a built-in LED display. Measurement accuracy required is within +/- 10 gm.

Indicate software implementation in the form of flow chart

D5. Design a four-channel tool displacement system for lathe machine to measure total displacement of 2cm with a resolution of 0.02mm i.e. 20mm. The tool displacement should be indicated on 3-½ digit LED display. The audible alarm should be triggered when the set point is exceeded. Transmit displacement data on RS485 interface to a remote location.

D6. Design an alarm annunciator for 4-channel pressure measurement system. When the set point is exceeded, the audible alarm should be triggered. The display window should start flashing and continue flashing till ACK, push button is pressed. The display window is switched OFF. When alarm condition vanishes. A Test button is provided with annunciator to check all display windows simultaneously.

(NOTE: Design should be based on Analog / Digital Circuit only and not on Micro controller)

D7. Design an ECG amplifier with 1 mV calibration facility. The chart display should be adjustable to 5mm / mV, 10mm/mV and 20 mm/mV. The heated stylus controls the intensity of trace. Provide PWM Control for heated stylus operated from +24 V DC supply. Stylus draws 1A current.

List of Assignments of Digital Design and Computer Organization:

1. Design and simulation of combinational logic using VHDL
   a) MUX, DEMUX, Encoder, Decoder.

   b) Comparator, Parity Generator / Checker

   c) Shifters

   d) ALU

2. Design and simulation of sequential logic using VHDL
   a) Flip-flop

   b) Counter and shift registers

   c) Design of FSM to detect any 2 / 3 bit sequence.

Reference Books:

1. Motorola, “Linear / Switch mode power supplies”
2. “National Semiconductor regulator design manual.”
3. “Philips small signal and power transistor manual.”
4. “Motorola power Transistors & Thyristors data hand book.”
5. Texas instruments, “Linear interface and applications circuit design”
6. www. Alldatasheets.com

7. www. national.com (use free power supply design tool from National Semiconductor website and design a multi output voltage SMPS using this tool.)
8. www.farnell.com
9. Franklin P. Prosser, David E. Winkel, “The art of digital design” ,(PHI),
10. Hill and Peterson, “Digital design”
11. Fletcher, “Introduction to digital design”
12. “Stephen Brown. Digital design using VHDL”
13. “Stepper motor controller using FPGA”
14. “Interface ADC/ DAC to FPGA”
15. Tubay Grame & Huelsmann (student Edition-Burr Brown), “Operational amplifiers”
16. Gobind Daryanani, “Principles of active networks synthesis and design”, John Wiley & Sons
17. Sergio Franco, “Design with Operational amplifiers and analog integrated circuits”, (3rd edition-TMH)
18. “PIC 16XX data book.”
19. “ATMEL micro controller data book.”
20. Peatman, “Micro controller system design”
21. www.atmel.com/products
22. www.8052.com
23. www.microchip.com
24. www.8051_hw.com

SEMESTER II

ADVANCED MICROPROCESSOR

Teaching Scheme

Examination scheme

Lectures / Week: 4 Hrs. Paper: 100 Marks

Practicals / Week: 2 Hrs.

UNIT I

Introduction to 16, 32 and 64 bit microprocessors, Comparison of features,

Generic methods to improve speed of execution, Microprocessor evolution - INTEL 8086 to Pentium with focus on- Clock speed, Concurrent operation of EU and BIU, Segmentation, Instruction set of 8086 and programming examples.

UNIT II

Memory management unit- Paging, Virtual memory, Real, Protected and virtual-86 mode of operation, Protection, Privilege levels, Multitasking, Exception handling in all above modes of operation, Pipelining, Pipelining hazards, Super-scalar architecture, Branch prediction.

UNIT III

DMA controller and Programmable Interrupt Controller, PC hardware - Mother board circuits, VGA Display adapter, Hard disk data organization, CD ROM interface, MOUSE, Keyboard interface.

UNIT IV

Evolution of buses - ISA, EISA, PCI, VME, VXI, PCMCIA,

Ports - Serial, Parallel, USB for Audio devices.

UNIT V

Operating system basics including file management, Process management, Memory management, Shell and shell programming, Command processing for following OS - DOS, LINUX, Windows, Resident programmes, Device driver structure.

UNIT VI

RISC and CISC processors and comparison of their features, Application areas,

Introduction of ARM processors - ARM Core, Versions and variants, Programming model, Instruction set.

Text Books:

1. **Ray & Bhurchandi.” Advanced Microprocessors & Peripherals”-TMH**
2. **N Mathivan ,”Microprocessors, PC hardware and interfacing”-PHI**

Reference books:

1. **Lieu Gibson**
2. **Uffenbeck**
3. **Peter Able,“8086 Assembly Language Programming”**
4. **Barry Brey, “Intel Processors 8086-80586”**
5. **Andrew N. Sloss, Dominc Synes, Chris Wrieght, “ARM System Developer’s Guide – Designing & Optimizing System Software”, Elsevier Inc.**

Advanced Microprocessor Lab

List of Assignments

1. **Arithmetic operations on unsigned/signed nos.[BCD packed, unpacked nos].**

2. **File handling, creation, reading, writing.**
3. **Pseudo device driver, device driver for printer for DOS.**
4. **Interfacing ADC/DAC using serial & Parallel port.**
5. **Interfacing peripheral using USB & PCI bus.**
6. **PC to PC communication.**
7. **Programming using ARM instructions.**

POWER ELECTRONICS

Teaching Scheme	Examination scheme
Lectures / Week: 4 Hrs	**Paper: 100 Marks**

UNIT I - Power Devices:

Structure, Characteristics, ratings of SCR, GTO, IGBT, Power Diode

Comparison of above devices with Power MOSFET & Power BJT

Driver Circuits (isolated & non-isolated) for IGBT & SCR

Protection circuits for IGBT & SCR

UNIT II - Single & three-phase AC/DC Converter:

Concept of line commutation

Single-phase half & fully controlled, Three phase half & fully Controlled bridges:

Circuit diagram, operation & waveforms for resistive and level (highly inductive) loads for above circuits.

An analysis of o/p voltage & supply current for single-phase bridges including the following performance parameters:

Average and RMS o/p voltage, Fourier series expressions for supply current. Derivation of fundamental power factor (Displacement power factor), Current distortion factor, Active, reactive & apparent power.

UNIT III - Single & Three-phase DC/ AC inverters:

Circuit diagram, operation & waveforms for single phase full bridge & Push pull inverters.

Switching techniques for obtaining square, quasi-square & sinusoidal PWM o/p waveforms.

Use of Pulse width modulated IC’s for Inverter control.

Fourier analysis of quasi-square waveform & harmonic load currents for R & RL loads.

Circuit diagram, operation & waveforms for three phase voltage source bridge inverters for 120 degree & 180 degree conduction for balanced star resistive load.

UNIT IV - Switched & Resonant DC/ DC converters:

Control of DC/ DC converters.

Circuit diagram, Waveforms & operation (o/p voltage calculation) of step down chopper (Buck converter), Step up chopper (Boost converter) & 2-quadrant type C chopper.

Circuit diagram, waveforms, operation, analysis & design aspects of Fly back converter (SMPS) including magnetics

Need for resonant converters:

Circuit diagram, waveforms & operation of SLR half bridge DC/DC converter in low frequency (discontinuous conduction) mode.

UNIT V - Single and three-phase AC/AC power controllers:

Principle of integral cycle and phase angle control

Circuit diagram, waveforms, operation and analysis of single-phase full wave controller with R and RL load.

Study of Triac based single phase controller

Use of IC TCA785 in phase angle control.

Circuit diagram, Waveforms and operation of three phase full wave controller with balanced star resistive load

UNIT VI - APPLICATIONS:

1) ON-line and OFF line UPS with battery AH, back up time, battery charger rating, calculations

2) Electronic ballast: characteristics of fluorescent lamps and advantages over conventional ballast

3) Single phase separately excited DC motor drive

4) HVDC transmission one line diagram, twelve pulse converter, arrangement and advantages over HVAC transmission

5) HF induction heating

6) Electric welding

Text Books:

1. M. H. Rashid, “POWER ELECTRONICS circuits devices and applications”, PHI, 3rd edition, 2004, New Delhi
2. M. S. Jamil Asgar, “POWER ELECTRONICS” ,PHI, 2004, New Delhi

3. N. Mohan, T. M. Undeland & W. P. Robbins, “POWER ELECTRONICS, Converters Applications and Design” John Willey and sons, 3rd edition, Singapore

Reference Books:

1. U. R. Moorthi, “POWER ELECTRONICS, DEVICES, CIRCUITS & INDUSTRIAL APPLICATIONS” , Oxford University Press, New Delhi, 2005
2. M D Singh & K B Khanchandani,”POWER ELECTRONICS”, TMH, New Delhi
3. P. C. Sen,”MODERN POWER ELECTRONICS”, S Chand & Co., New Delhi
4. “GE SCR MANUAL” 6th edition, General Electric, New York, USA

DIGITAL SIGNAL PROCESSING

Teaching Scheme — Examination scheme

Lectures / Week: 4 Hrs. — Paper: 100 Marks

Practicals / Week: 2 Hrs.

UNIT I - Introduction:

Basic elements of DSP and its requirements, Advantages of digital over analog signal processing, Analysis of LTI systems using Z-Transform, Introduction to analog filter design, Butterworth and Chebyshev approximation.

UNIT II - Analysis of Signals:

Discrete Fourier Transform, Properties, IDFT, Linear filtering methods based on DFT, FFT algorithms, Frequency analysis of discete time signals, Power density, Energy density, Goertzel Algorithm, Application of FFT : DTMF, Spectral Analysis, EEG, ECG.

UNIT III - FIR Filter Design and Applications:

Symmetric & Antisymmetric FIR filters, Design of FIR filters using windows, Frequency sampling methods, Alternation theorem in equiripple linear phase FIR filters, FIR differentiators, FIR filter structures - Direct form structures, Cascade form structures, Frequency – Sampling structures, Speech and voice processing, Digital sinusoidal generator.

UNIT IV - IIR Filters Design and Applications:

Filter design methods - Approximation of derivatives, Impulse invariance, Bilinear transformation, Characteristics of Butterworth, Chebyshev, Frequency transformations, IIR filter structures - Direct form, Parallel form, Lattice & Lattice-ladder structures, Speech and voice processing, Echo cancellation, Reverberation.

UNIT V - Multi rate Digital Signal Processing:

Introduction, Decimation by factor D, Interpolation by factor I, Sampling rate conversion by a rational factor I/D, Filter design & implementation for sampling rate conversion-Direct form FIR filter structures, Time variant filter structures, Sub-band coding of audio signals, Over- sampling A/D and D/A, STFT, Wavelet Transform.

UNIT VI - Analysis of Finite Word Length Effect:

Quantization process and errors, Analysis of coefficient quantization effects, A/D conversion, Noise Analysis, Analysis of Arithmetic round-off errors, Dynamic range scaling, Signal to noise ratio in low order IIR filters, Low sensitivity digital filters, Reduction of product round-off errors using error table, Limit cycles in IIR digital filters, Round-off errors in FFT algorithms, Desirable features and architecture of DSP Processor.

Text Books:

1. S.K.Mitra, “Digital Signal Processing”, TMH
2. Ifeachor, Jervis, “Digital Signal Processing ”, Pearson

Reference Books:

1. J.G.Proakis, D.G.Manolikis, “Digital Signal Processing ”, PHI
2. A.V.Oppenheim, R.W.Schaffeur, “Discrete Time Signal Processing ” John Wiley
3. Texas Instruments and Analog Devices DSP chip Manuals
4. Rabinder, Gold, “Theory and Application of Digital Signal Processing ”, PHI
5. Steven Smith, “Engineers and Scientists guide to DSP”

ELECTROMAGNETIC WAVES & RADIATING SYSTEMS

Teaching Scheme **Examination scheme:**

Lectures / week: 3 Hrs. **Paper: 100 Marks**

UNIT I - Review of static fields:

Concept of gradient, divergence and curl, Electric field intensity, Gauss’ law, work, energy, potential, Laplace, Poisson’s equations, Biot Savart law, current densities (**K**, **J**), Ampere’s circuital law, Continuity equation, Stoke’s theorem, Boundary conditions,

Qualitative treatment only, No numerical.

UNIT II - Maxwell’s equations and Time varying fields:

Maxwell’s equations in differential and point forms, Poynting vector, Time varying fields, Faraday law, Time periodic field and phasors, Energy stored in electric and magnetic time varying field.

UNIT III - Uniform plane wave and propagation:

Wave equations, Plane wave in loss less dielectric medium, Derivation of field equations, Lossy dielectrics, conducting medium, equivalent circuit, primary and secondary constants of medium, Boundary conditions with conducting and dielectric medium, skin depth, Phase velocity, group velocity, velocity of propagation.

UNIT IV - Transmission Lines:

Types of Transmission Lines, Transmission Line equations, Equivalent circuit, Primary and secondary constants, Termination of Transmission Line, VSWR, Reflection coefficient, Impedance matching of Transmission Line, l/4, Single stub, double stub, Application of Smith Chart.

UNIT V - Basic Antenna Theory:

Retarded scalar and vector potentials, Hertzian dipole, half wave dipole, loop antenna, field equations for near and far field, reciprocity of the antenna, antenna parameters – Field radiation pattern, power radiation pattern, beam width, Bandwidth, directive gain,

power gain, aperture, effective length, impedance, efficiency. Equivalent circuit of transmitting and receiving antenna, monopole antenna, antenna feeding techniques, Antenna Towers, Antenna Polarization.

UNIT VI - Type of Antenna:

End fire array, broadside array, Yagi Uda arrays. Turnstile, array factor. Qualitative treatment of horn, slot, parabolic, micro strip, helical and broadband antenna.

Text Books:

1. K. D. Prasad, “Antenna and wave propagation”, Satya Prakashan, Delhi.
2. Sadiku, “Elements of Electromagnetic”, Oxford.
3. Hayt & Buck, “ Engineering Electromagnetics “ ,TMH.

Reference Books:

1. N.Narayana, “Elements of Engineering Electromagnetics”, PHI.
2. Guru & Hiziroglu, Thomson,“Electromagnetic field- Theory and Fundamentals”.
3. Joseph Edminster, “Electromagnetics”, Schaum series.
4. John Kraus, “Electromagnetics with applications”, TMH.
5. John D. Ryder, “Networks lines and fields”, PHI.

INFORMATION THEORY AND CODING TECHNIQUES

Teaching Scheme Examination scheme

Lectures/week: 4 Hrs. Paper: 100 Marks

UNIT I - Information Theory and Source Coding:

Introduction, Uncertainty, Information and Entropy, Source coding theorem , data compaction, Discrete Memory less channels, Mutual information , channel capacity, channel coding theorem, differential entropy and mutual information for continuous ensembles.

UNIT II - Channel Capacity and Channel Coding:

Information capacity theorem, Implication of the information capacity theorem, information capacity of colored noise channel, rate distortion theory, data compression

UNIT III - Error Control Coding:

Introduction to error correcting codes, basic definitions, Matrix description of linear block codes, equivalent codes, Parity check matrix, decoding of linear block code, Syndrome decoding , error probability after coding, perfect codes, hamming codes, optional linear codes, maximum distance separable codes, Introduction to cyclic codes, polynomials The division algorithms for generating cyclic codes, matrix

description of cyclic codes, Burst error correction , Fire codes, Golay codes , Cyclic Redundancy check (CRC) codes, Circuit Implementation of cyclic codes.

UNIT IV - Convolutional Codes and Coding methods:

Introduction to convolutional codes, Tree codes and trellis codes, Polynomial description of convolutional codes, distance notions for convolutional codes, The generating functions, matrix description of convolutional codes, viterbi decoding of convolutional codes, distance bounds for convolutional codes, performance bounds, known good convolutional codes, Turbo codes, Turbo decoding, Introduction to TCM, Concept of coded modulation, mapping by set partitioning, Ungerboeck's TCM design rules, TCM decoder, performance evaluation for AWGN channel. Burst error correcting codes, FEC and ARQ systems , Performance of all codes.

UNIT V - Application of Information Theory:

Introduction to BCH codes, Primitive elements, Minimal polynomials, Generator polynomials in terms of Minimal polynomials, some examples of BCH codes, Reed-Solomon codes, implementation of Reed Solomon encoders and decoders

Data compression :Introduction to data compressions, The JPEG standard for loss less compression. Introduction to Cryptography, Overview of Encryption Techniques, RSA algorithm, application of information theory- An optimum modulation system, comparison of Amplitude Modulation system with the optimum system, comparison of FM systems, Comparison of PCM and FM communication systems.

UNIT VI - Communication Link Design:

Introduction to multi-user radio communications, Multiple-Access techniques, Introduction to satellite communications, Radio link analysis, wireless communications, Statistical characterization of multipath channels, Binary signaling over a Rayleigh Fading channel. TDMA and CDMA wireless communication systems, wireless standards-IS 95

Textbooks:

1) Ranjan Bose “Information Theory coding and Cryptography” TMH.

2) Simon Haykin “ Communication Systems” WSE publication, 4th Edition,

3) Taub and Schiling “Principles of Commutation Systems” TMH : 2nd Edition

Reference Books:

1) J.Das, S.K.Mullick, P.K. Chatterjee “Principles of Digital Communication” New age International publisher.

2) Bernard Sklar “Digital Communication-Fundamentals & Application” Pearson Education: 2nd Edition.

3) Theodore S. Rapparot “Wireless Communications-Principles & Practice” Pearson Education: 2nd Edition.

4) J. G. Proakis “ Digital Communication” MGH International : 4th Edition.

Electronics Lab – II

Teaching Scheme **Examination scheme**

Practicals / Week: 4 Hrs. **Practical: 50 Marks**

Term Work: 50 Marks

List of Assignments for Advanced Microprocessor Lab:

1. **Arithmetic operations on unsigned/signed nos.[BCD packed, unpacked numbers]**
2. **File handling, creation, reading, writing.**
3. **TSR for RTC, screen saver.**
4. **Pseudo device driver, device driver for printer for DOS.**
5. **Interfacing ADC/DAC using serial & parallel port.**
6. **Interfacing peripheral using USB & PCI bus.**

7. **PC to PC communication.**

8. **Programming using ARM instructions.**

List of Experiments for Power Electronics :

1. SCR, Triac, IGBT characteristics.
2. Triggering and Firing circuits for SCRs IGBTs / MOSFETs.
3. Single Phase half controlled bridge converter with R and RL load.
   OR

Single Phase full controlled bridge converter with R and RL and active (RLE)

load.

4. 3 Phase controlled bridge rectifier with R load.
5. Step Down chopper. (MOSFET or IGBT based)
6. Single-Phase Quasi square wave / PWM bridge converter with R and RL load.
7. Single-Phase AC regulator with R load.
8. Study of UPS / SMPS OR

Speed control of DC motor.

9. Simulation of buck converter.
10. Simulation of Single-Phase full converter with active load. (RLE)

List of Experiments for Electromagnetic Waves & Radiation Systems:

1. To measure the parameters of a transmission line.
2. To measure the parameters of an Antenna.

SIGNAL PROCESSING & COMMUNICATION LAB

Teaching Scheme Examination scheme

Practicals / Week: 4 Hrs. **Oral: 50 Marks**

Term Work: 25

List of Practicals for Digital Signal Processing

Assignments to be carried out using software such as MATLAB

1 Generation of sequences

a. Plot impulse response of causal finite dimensional discrete time system.

b. Autocorrelation and Cross correlation

2) To plot magnitude and Phase Spectra

a. To verify properties of DFT

b. To find N-point FFT and study the leakage effect.

c. Filter the noise corrupted signal using overlap add and overlap save method.

3) Design of FIR filter: Paper design and its verification (Frequency Response)

4) Design of IIR filter: Paper design and its verification (Frequency Response)

5) Dual tone multi frequency signal detection.

6) Spectral Analysis of Sinusoidal signals.

a. Spectral Analysis of Non-Stationary Signals.

b. Spectral Analysis of Random Signals.

7) Finite word length Effect

8) Spectrum analysis of a practical signal such as ECG or voiced word using FFT

List of Practicals for Information Theory & Coding

Following assignments may be implemented using Software tools like MATLAB and C / C++.

1. Implementation of algorithms for determination of various entropies and mutual information of a given channel.

Test various types of channel such as

i) Noise free channel.

ii) Error free channel

iii) Binary symmetric channel

iv) Noisy channel

2. Implementation of algorithm for generation and evaluation of variable length source coding using

i) Shannon – Fano coding

ii) Huffman Coding

3. Implementation of algorithms for generating and decoding linear block codes.
4. Implementation of algorithms for generating and decoding cyclic codes.

5. Implementation of algorithms for generating convolution codes using

i) Code Tree

ii) Code Trellis

6. Implementation of algorithms for decoding convolution codes using Viterbi's algorithm.
7. Study of radio link design.(Study assignment.)

ELECTRONIC SYSTEM DESIGN & MINI PROJECT

Teaching Scheme | Examination scheme

Practical / Week: 2Hrs. | **Oral: 50 Marks**

Term-work: 25 Marks

Assignment to cover following: -

a) Front end interface (transducer interface) including

Bridge type interface OR

Quadrature phase signal interface OR

Absolute (gray code) Encoder OR

Special purpose analog interface Ex. Thermocouple interface

b) One type of ADC and DAC with advance features by serial interface, processor compatibility.

c) Micro controllers (Micro chip-PIC/Atmel-89CXX)

d) 41/2 digit or similar display with selection criteria, LCD multilane alphanumeric;

Digital panel meter-IC

e) IC based keyboard encoder (Motorola CMOS data book)

f) Communication interface -

RS 485 or Optical interface or equivalent like as used in CAN / MODBUS protocols.

g) Standard 19” Rack General requirements in –

- Enclosure standards
- Front facia design
- Motherboard design
- Rear panel interface

h) Stepper motor translator/driver IC or (FHP-PM DC motor) driver IC- interface design.

Design assignments may include some of the following features:

1. Any parameter measurement and control system like temperature, humidity, airflow, speed, and pressure etc.
2. Power source just like battery along with float charger with solar panel backup, uninterrupted power supply
3. System containing motion control, different types of motor control and along with sensors feedback system
4. Industrial systems –Electronics controls for packaging machines, vending machines, cash registers, welding machine controls, CNC controllers, Digital read out systems, PLC based systems etc.
5. Electronic measuring instruments with computer interface, standard bus interface like IEEE488
6. Interface To FPGA Display /KBD/ADC/DAC/Stepper motor relay.
7. Electronic private exchanges EPABX, small communications systems, spread spectrum communication system
8. Automatic signal tracking system
9. Microwave link/satellite system
10. Assignment based on FSM design. Implementation using discrete ICs / PLDs

11. 1f or 3f energy monitoring system (Microprocessor / Micro controller based designs)

Reference Books:

1. Douglas V. Hall (TMH). Microprocessor and interfacing Programming and Hardware, Douglas V. Hall (TMH).
2. Microchip / Atmel application Notes
3. National Data Acquisition Systems manual.
4. Linear Applications Hand book-NS
5. Linear Interfacing and Application and circuit design- Texas Instruments.
6. Motorola interface data book.
7. C.D. Johnson (PHI), Process control instrumentation Technology, C.D. Johnson (PHI)
8. John Web, PLC design.
9. Otter, PLC design
10. Allen Bradley, SLC5XX users manual.
11. Siemens, PLC manual.
12. 19'' Rack design standards-

- Precident systems

- Elcon Precision

- HP product Catalogue.

Execution steps for Mini Project:

1. The circuit for mini-project will be part of design done in Electronic Design Work shop or System Design in Semester I and II respectively.
2. The circuit should be simulated using any of the standard simulation software available.
3. Result verification for paper design and simulation should be carried out and discrepancies should discussed.
4. Verified circuit should be assembled and tested on general purpose PCB / Protoboard for actual working and practical results.
5. Layout of circuit using any std. Layout tool (Orcad, Protel, CAD star, Pads, Ultiboard) should be design and PCB making process should be carried out.
6. Assembling and testing of circuit on PCB. This stage should consist of preparing bill of materials.
7. Design and fabrication of suitable enclosure with provision for external interfacing and power supply (wooden/plastic enclosure should not be used)
8. Testing of the circuit.
9. Preparation of project report to cover the project work and the details of work, which includes layouts, circuits, bill of material and relevant details. A binded (preference spiral) should be submitted to College.

SMPS Design using free National Semiconductor tool.

ELECTRONIC DESIGN WORKSHOP

Teaching Scheme | Examination scheme

Practical / Week: 2Hrs. | **Oral: 50 Marks**

Term-work: 50 Marks

Assignment to cover following: -

A. **Title – Design of Linear Regulated Power Supply**

Scope of Design:

1. Design the circuit with given specification.
2. Design the regulated DC Power Supply.
3. Indicators for Over voltage, over current.
4. Input power considerations and protection circuits (MOVs, EMI filters, Fuses, MCB)
5. Thermal considerations.
6. Verification of each designed circuit using any simulation software. (Printout should be part of submission).

Recommended Design Specifications (One Specification per batch from the following)

0 to 30V – 1.5A, 0 to +/-12V-1A, 5V-2A, 100V-100mA (using floating regulator)

0 to 12V-5A (using programmable regulator with proper step size), -5V – 0 to 5A, 1A – 30V max (current source generator) / 30 Ohm max, load R

For all the above designs consider mains variation – 15% to 10%

Find out load & line regulation and ripple.

B. FSM, ASM based Digital Design

Design to include:

1. FSM – sequence generator, sequence detector
2. Moore and Mealy machines, state diagram.
3. ASM technique – vending machine, Lift controller, traffic controller, Washing machine & Microwave oven, Automatic bottle filling plant.
4. Implementation – combinational logic in state machine using MSI, LSI devices like multiplexers, decoders, PLD's, ROM, fuse map generation, steps in designing using PAL.

Recommended Assignments:

FSM design (one per batch from sequence generator OR Sequence Detector)

a. **Sequence generator**:

Ex-1. A typical PN sequence generator

2. Six stage MLS counters using shift register (maximum length sequencer)

3. Gray code generator

4. Five bit decimal counter

b. Sequence detectors:

Ex – 1. A combinational lock

3. Flag detection in synchronous communication
4. Magnetic code detection / credit, debit card detection / ATM card

ASM design (One per batch from Industrial Application OR Domestic Application)

a. Automatic controllers in Industrial applications:

1. Automatic bottle filling plant

2. Vending Machines.

b. Automatic controllers in Domestic applications

1. Washing machine

2. Microwave oven

3. Food processor

C. Audio Power Amplifier System Design:

Scope of assignment shall be –

1. Source signal conditioning for sources like microphone, Tape head, CD, Tuner and Auxiliry input.
2. Mixer and Tone control/Graphic Equalizer (Maximum Five Band).
3. Driver and Power amplifier with volume control.
4. Cross over Network for Multiple Speaker System.
5. Sound Level Indication by Bar Graph Indication.
6. Considerations for Hum, Noise and distortion.
7. Appropriate Power Supply Design.
8. Design may incorporate IC's and transistors/MOSFETS.
9. Necessary short circuit protection.
10. Justified Component selection.

Recommended assignments: (One specification per Batch from the following)

Sources: Microphone, Tape Head, CD, Tuner and Auxiliary input..

Output Power: 10,20,30,50 Watts.

Speaker: 4, 8, 16 Ohms (Multiple Speakers may be used if required).

Frequency response: 40Hz to 16 KHz.

D. Microcontroller based data acquisition system:

Scope of assignments shall be –

a. Selection of transducer OR sensors for given specifications

b. Front end analog signal conditioning circuits

c. Selection of suitable A-D convertor

d. Selection of microcontroller

e. Storage memory local OR interface to PC (Serial, Parallel, USB Port

f. Local indication of parameters using LED/LCD

g. Output V/I (0 to 5V, 4 to 20mA), RS 2322C, RS485

h. Relay contact for control action.

i. Software skills for implementation in the form of flow chart

Recommended assignments: (One specification per batch from the following)

Design of DAS pertaining to acquisition & measurement & display of physical quantities such as temperature, pressure, level, displacement, flow, humidity.

E. Assignment of digital design & Computer Organization:

1. Design & Simulation of combinational logic using VHDL

   a. MUX, DEMUX, Encoder, Decoder
   b. Comparator, Parity generator/ Checker
   c. Shifters

2. Design & Simulation of sequential logic using VHDL

a. Flip flop

b. Counter & Shift registers

c. Design of FSM to detect any 2/3 bit sequence

Reference Books:

1. Motorola, “Linear / Switch mode power supplies”
2. “National Semiconductor regulator design manual.”
3. “Philips small signal and power transistor manual.”
4. “Motorola power Transistors & Thyristors data hand book.”
5. Texas instruments, “Linear interface and applications circuit design”
6. www. Alldatasheets.com
7. www. national.com (use free power supply design tool from National Semiconductor website and design a multi output voltage SMPS using this tool.)
8. www.farnell.com
9. Franklin P. Prosser, David E. Winkel, “The art of digital design” ,(PHI),
10. Hill and Peterson, “Digital design”
11. Fletcher, “Introduction to digital design”
12. “Stephen Brown. Digital design using VHDL”
13. “Stepper motor controller using FPGA”
14. “Interface ADC/ DAC to FPGA”
15. Tubay Grame & Huelsmann (student Edition-Burr Brown), “Operational amplifiers”
16. Gobind Daryanani, “Principles of active networks synthesis and design”, John Wiley & Sons
17. Sergio Franco, “Design with Operational amplifiers and analog integrated circuits”, (3rd edition-TMH)

18. “PIC 16XX data book.”
19. “ATMEL micro controller data book.”
20. Peatman, “Micro controller system design”
21. www.atmel.com/products
22. www.8052.com
23. www.microchip.com
24. www.8051_hw.com

List of Practicals – AIC Design and applications

All the practicals are to be performed on breadboard

1. Op-amp parameter measurement

Offset voltage, bias current, CMRR, Slew rate, Open loop gain.

2. Study of non-ideal parameters with general purpose (741C) & (OP07) op-amp

3. Op-amp applications –I Integrator, Differentiator (Frequency response, applications)

OR

3. Instrumentation amplifier (Interface with bridge) Compare with difference amplifier (using 3 op-amps with better parameters than IC 741

4. Op-amp applications - II

Window comparator (LM 339), OR

4. Schmitt Trigger (Asymetrical / Symetrical with high slew rate Op-amp)

5. Design Simulate build & test active filters.

Low pass, high pass, band pass, band stop.

6. PLL (Find Lock, Capture range & applications like frequency multiplier, AM detector)

7. Waveform Generators (Square & Triangular Generator with variable frequency using high slew rate Op-amp)

8. Precision rectifier (FWR / Frequency response upto 10 KHz and <= 50 mV using high band width op-amp)

9. V to I & I to V:

Input 0 to 1 V Output 4 to 20 A

Input 4 to 20 mA Output 0 to 1 V

10. Design builds & test input signal conditioning circuit for sensors

Like temperature sensors – LM 35, PT 100.

Strain guage sensors, PH sensors.

Circuit should have 0 & full scale adjustment.