## UNIVERSITY OF PUNE

TE (E&TC/Electronics Engg.)

### Semester I

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<th>Sr No</th>
<th>SUBJECT</th>
<th>TH (Hrs/Wk)</th>
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*Electronics Lab - I shall consist of practices based on subject no 2 and 4.

**Electronic Design workshop shall consist of assignments based subject no 1 and topics from analog filter design.

### Semester II

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DIGITAL DESIGN AND COMPUTER ORGANIZATION

Teaching Scheme Examination scheme Lectures / Week : 4

Paper : 100 Marks

UNIT I - Sequential Circuit Design:
Synchronous and asynchronous FSM design, Basic design steps, State encoding technique, 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 concept 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 receding 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"

Reference Books:
1. Fletcher, "Principles of Digital design"
2. Sudhakar Yalaman Chili, "Introductory VHDL from Simulation to Synthesis"
ANALOG INTEGRATED CIRCUITS - DESIGN & APPLICATIONS

Teaching Scheme Examination scheme Lectures / week : 4Hrs.

Paper : 100 Marks

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 1C 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 Sawtooth 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 cl 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 4th order)
c_{0p}, c_{0s}, a_{min}, a_{max}, Sallen and Key circuit I, II, ff
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 1C 565
Definitions-free running frequency, lock range, capture range, pull in time
Transfer characteristics of PLL
Applications of PLL - Frequency synthesizer, FM demodulator, AM demodulator,
FSJ demodulator

List of Practicals
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).
5. Design, Simulate, Build and Test Active filters.
6. To study the operation of 1C 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:

B) Reference Books:
3. Ramakant Gaikwad, "OP-AMP and Integrated Circuits", PHI.
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, transmission of random process through LTI filter, Gaussian Process, Power spectral density, Noise, Narrow band noise, Band limit filter, 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.

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), OMSK.

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, DS-SS 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.

**Reference Books:**
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.
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.
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)
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 -

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

Text Books:
1. Kenneth Ayala ,"8051 microcontroller" PHI
2. Predko ,"Programming and customizing 8051 microcontroller", TMH

Reference Books:
"1. Gaonkar," Microprocessor architecture" PHI
2. Ajay Deshmukh, "Microcontroller 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 (1C 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 microcontrollers with (89C series & PIC microcontroller), 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 Cable

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:

Reference Books:
2. Devdas Shetty, "Mecahatronics Systems Design" Thomson Publication

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 microcontroller 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/Microcontroller)
9) Study Of Mechatronics system II -Using Components sensors Actutaors, PLC/Microcontroller)
10) Study of Mechatronics system III-Using Components sensors Actuators, PLC/Microcontroller)

NOTE:
Experiments should be executed using Simulators, Virtual Lab platform such as Lab View.
ELECTRONICS LAB -1
Teaching Scheme Examination scheme Practicals / Week : 4Hrs.
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).
5. Design, Simulate, Build and Test Active filters.
6. To study the operation of 1C 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 Microcontrollers & 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
ELECTRONIC DESIGN WORKSHOP

Teaching Scheme. Examination scheme. Practicals / Week : 2 Hrs.

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, 30V max (current source generator) / 30Q 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.
   d) Implementation - combinational logic in state machine using MSI, LSI devices like multiplexers, decoders, PLDs, ROM, fuse map generation, steps in designing using PAL

Bl) 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 fo=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 fo= 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 fo= 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 3rd and 4th order. II Other types responses like Chebyshev, Cauer.

**Band Stop Filter / Notch Filter:**
**Part A:** Design a Second order notch filter with fo= 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 3rd and 4th 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 Microcontroller
   e) Output interfacings: i) Relay
      ii) Display (Single LED) iii) DAC with PWM for analog output

Dl. Temperature measurement systems:
Design data acquisition system to measure temperature between 20 C to 90 C with resolution of 1°C 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°C. Accuracy of 1% should be achieved.
Design front end / i/p'ride signal conditioning scheme, select a Microcontroller 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) & Hysteresis

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 Microcontroller 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 Microcontroller 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. Microcontroller 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
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. 20(j.m. The tool displacement should be indicated on 3/-2 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 Design and simulation of combinational logic using VHDL
a) MUX, DEMUX, Encoder, Decoder.
b) Comparator, Parity Generator / Checker
c) Shifters
d) ALU 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."
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"
13. "Stepper motor controller using FPGA"
14. "Interface ADC/ DAC to FPGA"
15. Tubay Grame & Huelsmann (student Edition-Burr Brown), "Operational amplifiers"
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.

17. Sergio Franco, "Design with Operational amplifiers and analog integrated circuits", (3rd edition-TMH)
20. Peatman, "Micro controller system design"
22. www.8052.com
23. www.microchip.com
24. www."8051_hw.com
Advanced Microprocessor Lab List of Assignments
1. Arithmetic operations on unsigned/signed nos. [BCD packed, unpacked nos].
2. File handling, creation, reading, and 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

Text Books:
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"
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
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 √20 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:

Reference Books:
DIGITAL SIGNAL PROCESSING
Teaching Scheme Examination scheme
Lectures / Week : 4 Hrs. Paper : 100 Marks
Practical / Week : 2 Hrs.

UNIT I - Introduction:
Basic elements of DSP and its requirement, 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 discrete time signals, Power density, Energy density, Goertzel Algorithm, Application of FFT : DTMF, Spectral Analysis, EEC, ECG.

UNIT III - FIR Filter Design and Applications:
Symmetric & Ant symmetric 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:

Text Books :
2. Ifeachor, Jervis "Digital Signal Processing ", Pearson

Reference Books :
3. Texas Instruments and Analog Devices DSP chip Manuals
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:
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:
3. Hayt & Buck, "Engineering Electromagnetics ",TMH.
Reference Books:
1. N.Narayana, "Elements of Engineering Electromagnetics", PHI.
4. John Kraus, "Electromagnetics with applications", TMH.
5. John D. Ryder, "Networks lines and fields", PHI.
INFORMATION THEORY AND CODING TECHNIQUES

Teaching Scheme
Lectures/week: 4 Hrs.

Examination scheme
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, Generate polynomials in terms of Minimal polynomials, some examples of BCH codes, Reec 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, RS, algorithm, application of information theory- An -optimum modulation systen 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 technique; Introduction to satellite communications, Radio link analysis, wireless communication: Statistical characterization of multipath channels, Binary signaling
over a Rayleigh Fading channel. TDMA and CDMA wireless communication systems, wireless standards-IS 95

**Text books:**
1) Ranjan Bose "Information Theory coding and Cryptography" TMH.
3) Taub and Schiling "Principles of Commutation Systems" TMH : 2nd Edition

**Reference Books:**
Electronics Lab - II
Teaching Scheme Examination scheme Practical / 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.
List of Experiments for Power Electronics:
1. SCR, Triac, IGBT characteristics.
2. Triggering and Firing circuits for SCRs IGBTs / MOSFETs.
4. 3 Phase controlled bridge rectifier with R load.
5. Step Down chopper. (MOSFET or IGBT based)
7. Single-Phase AC regulator with R load.
8. Study of UPS / SMPS OR Speed control of DC motor.
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 Practical / 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 multifrequency signal detection.
6) Spectral Analysis of Sinusoidal signals.
7) Finite word length Effect
8) Spectrum analysis of a practical signal such as ECG or voiced word using FFT
ELECTRONIC SYSTEM DESIGN & MINI PROJECT
Teaching Scheme Examination scheme Practical / Week : 2Hrs.
Oral: 50 Marks
Termwork : 25 Marks
Assignments 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) 1C 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 1C or (FHP-PM DC motor) driver 1C- 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. 1<|> or 3<|> 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).
3. Linear Applications Hand book-NS
4. Linear Interfacing and Application and circuit design- Texas Instruments.
6. C.D. Johnson (PHI), Process control instrumentation Technology, C.D. Johnson (PHI)
7. John Web, PLC design.
8. Otter, PLC design
10. Siemens, PLC manual.
11. 19" Rack design standards-
   - Precident systems
   - Eicon Precision
   - HP product Catalogue.

Execution steps for Mini Project:
1. The circuit for mini-project will be part of design done in Electronic Design Workshop 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 (Oread, 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 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)
Recommended Design Specifications (One Specification per Batch from the following)
0 to 30V-1.5 A, 0 to +/-12V-1 A, 5 V-2 A, 100V-100mA A(using floating regulator) 0 to 12V- 5A(using programmable regulator with proper step size), -5V-0 to 5A, I A-30Vmax (current source generator) / 30Q max, load R For all the above designs consider mains variation -15% to 10%, Find out load and line regulation and ripple.
B) FSM, ASM based Digital Design Design to include:
a) FSM - sequence generator, sequence detector
b) Moore and Mealy machines, state diagram.
d) Implementation - combinaional logic in state machine using MSI, LSI devices like multiplexers, decoders, PLDs, 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 combinaional lock
2) Flag detection in synchronous communications
3) 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 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) **Audio Power Amplifier System Design: Scope of assignments shall be -**
   1. Source signal conditioning for sources like Microphone, Tape head, CD, Tuner and Auxilary 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.
   8. Design may incorporate IC's and Transistors/MOSFETS.
   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) **Micro controller Based Data Acquisition System:**
   **Scope of assignments shall be -**
   a) Selection of Transducer OR Sensor for given Specification.
   b) Front end analog signal conditioning circuit.
   c) Selection of suitable A to D converter.
   d) Selection of Micro controller.
   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 5 volt, 4 to 20ma), RS 2322C, RS485. h) Relay contact for control action.

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**List of practicals - A 1C Design & Applications**

* All the Practical arc to be performed on Bread Board.

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) & (OP 07) Op-Amps.
3. Op-Amp Applications-1
Integrator, Differentiator, (Frequency response, Applications)  
OR  
3. Instrumentation Amplifier (Interface with bridge)  
Compare with Difference Amplifier, (using three op-amps with better parameters than 1C 741)  
4. Op-Amp Applications-II  
Window Comparator (LM339),  
OR  
4. Schinitl Trigger (Asymmetrical/Symmetrical with high slew rate op-amp.)  
5. Design Simulate Build & Test Active Filters.  
Low pass, High pass, band pass, Band stop.  
6. PL1, (Find lock, capture range and applications like frequency multiplier, AM detector)  
7. Waveform Generators.(Square and Triangular generator with Variable frequency Using high slew rate op-amp.)  
8. Precision rectifier (FWR /Frequency response up to 10 kHz and input <- 50mv. Using high Band width op-amp)  
9. V to I and Ho V:  
Input 0-1V Output 4-20mA Input 4-20mA, Output 0-1V.  
Strain Gauge sensors, PH sensors Circuit should have Zero and Full-scale adjustment.  
i) Software scheme for implementation in the form of flowchart  
Recommended Assignments: (One Specification per Batch from the following)  
Design of DAS pertaining to Acquisition and Measurement and Display of Physical Quantities such as Temperature, Pressure, Level, Displacement, Flow, Humidity.  
E)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  
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."  
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"
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17. Sergio Franco, "Design with Operational amplifiers and analog integrated circuits", (3rd edition-TMH)
20. Peatman, "Micro controller system design"
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24 www.8051Jw.com