MAHATMA GANDHI UNIVERSITY

B.TECH. DEGREE COURSE

6^{TH} SEMESTER

SCHEME
&
SYLLABUS

2002

ELECTRICAL
&
ELECTRONICS
ENGINEERING BRANCH

ELECTRICAL & ELECTRONICS ENGINEEING

SCHEME

6TH SEMESTER

Course Code	Course No.	Subject	Teaching Hours				Duration of Univ. Exam(Hrs.)	Maximum Marks		
			L	T	P	Total		Sessional	University	Total
A	E 601	Control Systems - I	3	1		4	3	50	100	150
B	E 602	Electrical Machines - II	3	1		4	3	50	100	150
C	E 603	Electrical Power Transmission	3	1		4	3	50	100	150
D	E 604	Digital Signal Processing	2	1		3	3	50	100	150
E	E 605	Microprocessors and Applications	3	1		4	3	50	100	150
F	E 606	Computer Organisation	2	1		3	3	50	100	150
G	E 607	Digital Lab			4	4	3	50	100	150
H	E 608	Systems Lab			4	4	3	50	100	150
		Total	16	6	8	30	24	400	800	1200

SYLLABUS

CONTROL SYSTEMS - I

E 601 **3+1+0**

Module 1

Introduction: Concept of a system – control system – open-loop system – levels of sophistication in a control system – mathematical model of physical systems – plant representation – transfer functions – block diagrams – signal flow graphs – effects of feedback on parameter variations, system dynamics and disturbance signals.

Module 2

Time response analysis: Type and order of a system – time domain analysis of systems – typical test input signals – response of first order systems to unit step, unit ramp, and unit impulse signals – step response of second order systems – performance characteristics of feed back control systems – time domain behaviour from pole-zero plot

Steady state errors and error constants – generalized error constants – improvement of performance by derivative control, integral control, PID control.

Module 3

Concepts of Stability: BIBO stability – asymptotic stability – Routh Hurwitz stability criterion – relative stability – root locus technique – construction of root loci – root contours – systems with transportation lag.

Module 4

Frequency response analysis: Correlation between time and frequency response – polar plots – bode plots – relative stability – phase margin and gain margin – minimum and non-minimum phase systems.

Module 5

Stability in Frequency domain: Nyquist stability criterion – relative stability.

Control System Components: synchros – resolvers – rotating amplifiers – magnetic amplifier – Amplidyne – Tachogenerators – DC and AC servo motors – Gyroscopes – stepper motor.

References

1. Modern Control Engineering: Katsuhiko Ogatta, Pearson Education Asia
2. Analog and Digital Control System Design: Chi Tsong Chen, Oxford University Press
3. Modern Control Systems: Dorf and Bishop, Addison Wesley, LPE, 9th Ed.
4. Control System Design & Principles: M. Gopal, TMH

ELECTRICAL MACHINES - II

E 602 **3+1+0**

Module 1

Synchronous Machines: Types – selection of alternators – constructional features of cylindrical and salient pole machines.

Armature windings: different types – phase grouping – single and double layer, integral and fractional slot winding – emf equation – distribution factor – coil span factor – tooth harmonic ripples – skewed slots – harmonics, elimination of harmonics – revolving magnetic field.

Module 2

Armature Reaction – Synchronous reactance – circuit model of synchronous machine.

Regulation – predetermination – emf, mmf and potier methods, saturated synchronous reactance – Phasor diagrams – short circuit ratio – two-reaction theory – Phasor diagram – slip test – measurement of X_d, X_q, losses and efficiency of synchronous machines.

Module 3

Parallel operation of alternators – load sharing – synchronising power and torque – governor characteristics – method of synchronising – synchroscope.

Synchronous Motor: Principles of operation – torque and power relationships – Phasor diagram – hunting in synchronous machines – damper winding – starting of synchronous motors.

Module 4

Synchronous machines connected to infinite bus – power angle characteristics of cylindrical rotor and salient pole machines – reluctance power – steady state stability limit – V-curves – inverted V-curves – O-curves – synchronous condenser – symmetrical short circuit of unloaded alternators – steady state, transient and sub-transient reactance – current variation during short circuit.

Module 5

Generalised Machine Theory: Dynamic representation of generalised machines – formation of emf equation – expression of power and torque – representation of DC machines – synchronous machine and Induction motor.

Excitation systems: different types – comparison – exciter ceiling voltage – excitation limits – exciter response – methods of increasing the response of an exciter.

Brushless Alternators: Principle of operation constructional features – excitation methods – voltage regulation.

References

1. The performance and Design of AC Machines: M.G. Say
2. Theory of Alternating Current Machinery: Alexander Langsdorf
3. A course in Electrical Engg. Vol.2: C.L Dawes

4. Power System Stability – Vol. 3: E.W Kimbark
5. Electrical Machines: P.S Bhimbra
6. Generalised Theory of Electrical machines: P. S Bhimbra
7. Theory and performance Electrical Machines: J.B Gupta

ELECTRICAL POWER TRANSMISSION

E 603 **3+1+0**

Module 1

Transmission Line Constants: Resistance – skin effect – proximity effect.
Inductance of single phase line – inductance of three phase line with symmetrical and unsymmetrical spacing – transposed line.
Capacitance of single phase line – capacitance of three phase line with symmetrical and unsymmetrical spacing – transposed lines – effect of earth on line capacitance – geometric mean distance – geometric mean radius

Module 2

Overhead Lines: Mechanical characteristics - Conductor – bundled conductors – line supports – spacing between conductors – sag and tension calculations – effect of ice and wind - sag at the time of erection – vibration and dampers
Line insulators: Different types – pin type – suspension type – strain type – potential distribution of a string of suspension insulator – string efficiency – equalization of potential – testing of insulators

Module 3

Performance of Transmission Lines: Classification of transmission lines – analysis of short lines- medium line by nominal pi and T methods – rigorous solution of long lines – A, B, C, D constants – Ferranti effect – losses in an open circuited line – power flow through transmission lines
Voltage Control: Different methods – static capacitor – tap changing transformer – booster transformer – phase modifier – power circle diagram – calculation

Module 4

Corona: Critical disruptive voltage – visual critical voltage – power loss – factors affecting – methods to reduce corona – radio interference effect
Substations: Types - general layout - neutral grounding – resistance earthing – reactance earthing – arc suppression coil earthing – grounding transformer - Power system earthing - measurement of earthing resistance

Module 5

Extra High Voltage Transmission: Need for EHV transmission – limitations of EHV AC transmission – requirements of EHV lines - reactive compensation in EHV systems – EHV systems in India.
HVDC Transmission - Advantages and disadvantages – Graetz circuit – inversion – kinds of d.c. links – economic distance of DC transmission

References

1. Modern Power System Analysis: Nagrath and Kothari, TMH
2. Electrical Power Systems: C. L. Wadhwa, New Age Int'l
3. Electrical Power: Uppal
4. A Course in Electrical Power Systems: Soni, Gupta, Bhatnagar
5. HVDC Power Transmission System: K. R. Padiyar
6. Power System Analysis: Bergen, Pearson, 2/e

DIGITAL SIGNAL PROCESSING

E 604 **2+1+0**

Module 1

Introduction: Elements of a Digital Processing System - Advantages of Digital over Analog Signal Processing. Applications of DSP.

Discrete-Time Signals and Systems: Elementary Discrete-Time Signals-Classification of Discrete-Time Systems - LTIV systems- -Causality, Stability.

Frequency Domain representation of discrete-time signals: Fourier transform of a sequence - properties of Fourier Transforms.

Module 2

Discrete Fourier Transform: Properties of DFT-Linearity-shifting property, symmetry property, Convolution of a sequence. Fast Fourier Transform Decimation-in time radix- two FFT- decimation in frequency radix-two FFT.

Module 3

Review of z transforms: inverse z-transform - properties of z- transforms.

Realisation of digital filters: Direct and cascaded structures for FIR filters - direct and cascade and parallel structures for IIR filters.

Module 4

FIR filters: characteristics of practical frequency selective filters-characteristics of FIR filters with linear phase - design of linear phase FIR filters using windows-rectangular, Hamming, Hanning and Kaiser windows, FIR filter design using frequency sampling.

Module 5

IIR filters: Properties of IIR filters-design of IIR digital filters from analog filters-Butterworth design-Chebyshev design - impulses invariant transformation-Bilinear transformation.

DSP chips: TMS 320C family - features and block schematic of simplified architecture.

References

1. Digital Signal Processing – Alan V. Oppenheim and Ronald W. Schafer, Pearson Education Asia, LPE
2. Digital Signal Processing - John G. Proakis and Dimitris G. Manolakis
3. Digital Signal Processing: A Practical Approach – Emmanuel C. Ifeachor and Barrie W. Jervis, Pearson Education Asia, LPE
4. An Introduction to Digital Signal Processing: Johny R. Johnson

MICROPROCESSORS AND APPLICATIONS

E 605 **3+1+ 0**

Module 1

Evolution of Processors – single chip microcomputer – Intel 8085 Microprocessor – signals – architecture of 8085 – ALU – register organisation – timing and control unit – microprocessor operations – instruction cycle – fetch, decode and execute operation – T-state, machine cycle and instruction cycle – timing diagram of opcode fetch, memory read, I/O read, memory write and I/O write cycles – wait state.

Module 2

Instruction set of 8085: Classification of instructions – different addressing modes – writing assembly language programs – typical examples like 8 bit and 16 bit arithmetic operations, finding the sum of a data array, finding the largest and smallest number in a data array, arranging a data array in ascending and descending order, finding square from look-up table. Counters and time delays – delay using one register, two registers and register pair.

Module 3

Stack and Subroutines: Stack pointer – stack operations – call-return sequence – examples

Interrupts of 8085: restart instructions – interrupt structure of 8085 – vectored locations – SIM and RIM instructions – software and hardware polling.

Module 4

Memory interfacing **-** ROM and RAM – interfacing I/O devices – address space partitioning – memory mapped I/O and I/O mapped I/O schemes – interfacing I/Os using decoders – the 8212 I/O device – interfacing LED and matrix keyboard – programmable peripheral devices – 8155 and 8255, block diagram, programming simple input and output ports.

Module 5

Different data transfer schemes: synchronous and asynchronous data transfer – programmed and interrupt driven data transfer.

Applications of microprocessor in system design: interfacing ADC 0808 – interfacing DAC 0800. DMA controller 8257-Interfacing of stepper motor – interfacing of 8279 keyboard /display controller- 8275 CRT controller.
Architecture and operation of 8086.

References

1. Microprocessor Architecture, Programming and Applications: R.S. Gaonkar, Penram Intl'
2. Fundamentals of Microprocessors and Microcomputers: B. Ram, Dhanpat Rai and Sons
3. 0000 to 8085: Introduction to Microprocessors and Engineers: P.K Ghosh, PHI
4. Microprocessors and Digital Systems: Douglas V. Hall, McGraw Hill
5. Introduction to Microprocessors: A.P Mathur, TMH
6. Digital Electronics and Microprocessors: Malvino, TMH

COMPUTER ORGANISATION

E 606 **2+0+ 0**

Module 1

Introduction: Functional block diagram of digital computer – processor organization – typical operation cycle: fetch, decode and execute – microprogrammed Vs hardwired control (basic concepts only) – bus structures.

Module 2

Arithmetic and Logic unit: Adders- serial and parallel adders- fast adders- carry look ahead adder- 2's complement adder/subtractor- multiplication and division operations (description using block schematic diagrams only)-design of Logic unit-one stage ALU.

Module 3

Memory System: memory parameters – main memory – cache memory – auxiliary memory – semiconductor RAM – Static RAM –Dynamic RAM – ROM – PROM – EPROM – E^2PROM – Flash Memory.
Programmable Logic Devices: PAL, PLA, FPLA, Applications.

Module 4

Memory Organisation: Internal Organisation of memory chips – cache memory – mapping functions – direct mapping – associative mapping – set associative mapping – memory interleaving – Hit and miss – virtual memory – organization – Address translation.

Module 5

Input/Output Organisation: access to I/O Devices – Interrupts – Enabling and Disabling of Interrupts – Handling multiple devices –Buses – Synchronous and Asynchronous buses.

Data Communication interfaces and standards: parallel and serial ports – RS232, RS423 serial bus standards –GPIB IEEE488 Instrumentation bus standard- PCI, SCSI, USB (basic ideas only).

References

1. Computer Organisation: V. Hamacher – Mc Graw Hill
2. Logic and Computer Design Fundamentals: M. Morris Mano
3. 2/e Pearson Computer Organisation and Design: P. Pal Chaudhari – PHI
4. Digital Computer Fundamentals: Thomas Bastee

DIGITAL LAB

E 607 **0+0+4**

1. Study of TTL gates
2. Characteristics of TTL gates
3. Realisation of sequential circuits
4. Study of SR. JK, D, T and JK Master-Slave Flip Flops
5. Study of seven segment display
6. Testing of different shift registers
7. Design and Testing of decoders and encoders
8. Design and testing of astable and mono-stable multivibrator using 555
9. Design and testing asynchronous and synchronous counters and modulo N counter
10. Design and testing of counters using shift registers
11. Realisation of ADC and DAC
12. Testing of arithmetic circuits using op-amps
13. Design and testing of square wave generation using op-amps
14. Study of IC Regulator Power supplies

SYSTEMS LAB

E 608 **0+0+4**

1. 8085 assembly language programming experiments
    a. 8-bit and 16 bit arithmetic operations
    b. Arranging a data array in descending and ascending order
    c. BCD to binary and binary to BCD conversion
    d. Finding square root of a number
    e. Finding out square root of a number using look-up table
    f. Setting up time delay and square wave generation

   g. Interfacing of LEDs, 7 segment displays
   h. Traffic control signals
   i. Interfacing of stepper motor
   j. Interfacing of ADC
   k. Interfacing of DAC
   l. Generation of firing pulses for SCR.
   m. Interfacing of Power devices
   n. Interfacing LCD displays
2. VCO circuits using IC 566, 4046B etc.
3. PLL systems using IC 565, 4046B etc.
4. Multiplexed Displays