### 3rd Semester

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**6\textsuperscript{th} Semester**

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Total 18 6 6 450 600 150 1200
Module 1

Module 2
Vector integral calculus: Line- surface and volume integrals- work done by a force along a path- application of Green’s theorem- Stoke’s theorem and Gauss divergence theorem.

Module 3
Function of complex variable: Definition of analytic function and singular points- derivation of C.R. equations in Cartesian co-ordinates- harmonic and orthogonal properties- construction of analytic function given real or imaginary parts- complex potential- conformal transformation of functions like $Z^n$, $e^z$, $1/z$, Sin $z$, $z + k^2/z$ - bilinear transformation- cross ratio- invariant property- simple problems.

Module 4
Finite differences: meaning of $\Delta$, $\nabla$, $E$, $\mu$, $d$ - interpolation using Newton’s forward and backward formula- central differences- problems using Stirlings formula- Lagrange’s formula and Newton’s divided difference formula for unequal intervals.

Module 5

References
5. Advanced Engineering Mathematics: Michael D Greenberg- PHI.

NETWORK THEORY

LA 302 2+1+0

Module 1
Source transformation- Mesh and Node voltage Analysis – Coupled circuits – Dot conventions – Analysis of coupled circuits.

Module 2

Module 3

Module 4

Module 5

References

1. Network analysis -M.E Van Valkenburg, PHI
2. Circuits and Networks – analysis & synthesis – A. Sudhakar & S P ShyamMohan
3. Network and Systems -D Roy Chaudhary
4. Network analysis and synthesis-Franklin F Kuo – John Wiley & Sons

ELECTRICAL TECHNOLOGY

LA 303

Module 1


Module 2


Module 3

Module 4

Module 5

References
1. Electrical & Electronic Technology: Hughes, Pearson Education
2. Electrical Technology: H. Cotton
3. Electrical Machines: R.K.Rajput
5. Electrical Machines & Power systems: Vincent Del Toro

SOLID STATE DEVICES
LA304 3+1+0

Module 1
Energy bands and charge carriers in semiconductors: energy bands- metals- semiconductors and insulators- direct and indirect semiconductors- charge carriers in semiconductors: electrons and holes- intrinsic and extrinsic material- n-material and p-material- carrier concentration: fermi level- EHPs- temperature
dependance- conductivity and mobility- drift and resistance- effect of temperature and doping on mobility- hall effect.

**Module 2**
Diffusion of carriers- derivation of diffusion constant D- Einstein relation- continuity equation- p-n junctions: contact potential- equilibrium fermi levels- space charge at junctions- current components at a junction: majority and minority carrier currents- zener and avalanche breakdown- capacitance of p-n junctions.

**Module 3**
p-n junction diodes: volt-ampere characteristics- switching time- rectifier action- Zener diodes: volt-ampere characteristics- Tunnel diodes: tunneling phenomena- volt-ampere characteristics- Varactor diodes- Photo diodes: detection principle- light emitting diodes.

**Module 4**
Bipolar junction transistors: npn and pnp transistor action- open circuited transistor- biasing in active region- majority and minority carrier distribution- terminal currents- amplification and switching- a and β gain factors- emitter efficiency?- schottky transistors- photo transistors.

**Module 5**
Field effect transistors: operation- pinch off and saturation- pinch off voltage- gate control- volt-ampere characteristics- MOSFETS: n MOS and p MOS: comparison- enhancement and depletion types- control of threshold voltage- MOS capacitance.

**References**

1. Solid state electronic devices - Ben G Streetman- Pearson Education
2. Microelectronic Devices: Nagchaudhari, Pearson Education
6. Physics of semiconductor devices: Shur- PHI.
7. Theory of Semiconductor devices: Karl Hess- PHI.
Module 1
Rectifiers and Power supplies: Half wave- full wave and bridge rectifiers- working- analysis and design- C filter analysis- regulated power supplies: series and shunt- design of regulated power supplies for specified output conditions- current limiting- short circuit protection- IC regulated power supplies.

Module 2
Transistor as an amplifier: Transistor at low frequencies- h parameter model analysis- expression of voltage and current gain- input and output impedance- CE- CB and CC configurations- comparison- transistor parameters from static characteristics- FET: operation- characteristics- small signal model.

Module 3
Transistor Biasing: operating point- DC and AC load lines- Q point selection- bias stability- definition of stability factors- derivation of stability factor for \( I_{CO} \) variation- fixed bias- collector to base bias- self bias circuits- bias compensation- compensation for \( I_{CO} \) and \( V_{BE} \).

Module 4
RC Coupled amplifier: working- analysis and design- phase and frequency response- FET amplifier: biasing- analysis and design.

Module 5
Wave shaping circuits: clipping- clamping- RC integration- differentiation- transistor as a switch- astable multivibrator- working and design- UJT- working and applications- simple sweep circuit.

References
4. Electronic devices and circuits: Bogart- UBS.
5. Electronic devices and circuits: Allen Mottershed- PHI.
7. Electronic devices and applications: B Somanathan Nair- PHI.
Module 1

Introduction to C: C fundamentals - The character set - identifiers and keywords - Data types - constants - variables and arrays - declarations - expressions - statements - symbolic constants - arithmetic operators - Relational and Logical operators - The conditional operator - Library functions - Data input and output - getchar – putchar, scanf, printf - gets and puts functions - interactive programming.

Module 2

Control Statements: While - do while - for - nested loops - if else switch - break - continue - The comma operator - go to statement, Functions - a brief overview - defining a function - accessing a function - passing arguments to a function - specifying argument - data types - function prototypes - Recursion.

Module 3


Module 4

Pointers: Fundamentals - pointer declaration - passing pointers to a function - pointers and one dimensional arrays - operations on pointers - pointers and multi dimensional arrays – passing functions to other functions.

Module 5
**Data files**: Opening and closing of a data file - creating a data file - processing a data file, low level programming - register variables – bit wise operation - bit fields - enumeration - command line parameters - macros - the C pre-processor.

**Text Book**


**References**

1. Theory and problems of programming with C- Gottfried, Schaum’s series.
2. The C programming language: Kernighan & Ritche, PHI.
5. Programming Ansi C: Ram Kumar.
6. Computer Programming: Rajaraman, PHI.

**ELECTRICAL LAB**

**LA 307**  
0+0+4

1. Measurement of Electric power (single phase and three phase) and energy using wattmeter and energy meter.
2. Study of star-delta connections.
3. O.C.C. and Load characteristics of D.C. generators.
4. Swinburne’s test.
5. Load characteristics of D.C. shunt, series and compound motors
7. Load test on step-up/step-down transformer; calculation of efficiency and regulation at different power factors.
8. Study of starting of three phase induction motors and load test on squirrel cage induction motor.
9. Load test on slipring induction motor.
10. Study of stepper and servomotors.
11. Load test on single phase induction motor.
12. Pre-determination of regulation of the alternator by emf and mmf method.

**BASIC ELECTRONICS LAB**

**L 308**  
0+0+4
1. Familiarization of CRO, DVM, AF generator etc and soldering practice.
2. Characteristics - Diode, Transistor, FET, UJT. Determination of parameters.
3. Design and testing of DC power supplies for specified output.
8. Simple sweep circuit.
10. Simulation of simple circuits using Spice.

Note
New experiments may be added in the above list concerned to the relevant theory paper (LA 305).
Module 1

Module 2
Partial Differential Equations - formation by eliminating arbitrary constants and arbitrary Functions - solution of Lagrange Linear Equations –Charpits Method – solution of homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

Module 3

Module 4
Probability and statistics: Binomial law of probability - The binomial distribution, its mean and variance - poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, poisson and normal distributions.

Module 5
Population & Samples: Sampling distribution of mean (σ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, difference of proportions, single mean and difference of means (proof of theorems not expected).

References

**DIGITAL ELECTRONICS AND LOGIC DESIGN**

**Module 1**

**Module 2**

**Module 3**

**Module 4**

**Module 5**
Registers and Counters - Buffer Registers - Shift Registers - Controlled Shift Registers - Ripple Counters - Synchronous Counters - Ring counters - Modulo counters - Three-State Register. ROMs – PROMs and EPROMs - RAMs. A small TTL Memory.

**References**
3. Fundamentals of digital circuits: A Anand Kumar, PHI
4. Digital Integrated Electronics: Taub and Shilling, McGraw Hill,
6. Digital Logic and state machine design: Comer, Oxford.

COMMUNICATION ENGINEERING

LA 403 3+1+0

Module 1

Introduction: communication systems – Modulation - need for modulation-bandwidth- Amplitude modulation - theory- mathematical representation-frequency spectrum - USB & LSB- power relation- Frequency modulation - theory- mathematical representation- frequency spectrum- Phase modulation-comparison of AM- FM- PM.

Module 2


Module 3

Module 4

Module 5
Telephone Systems - Telephone subscribers loop circuit - subscribers line interface circuit - Pulse and tone signaling - Frequency assignments - Electronic telephone - block schematic of a telephone set - block schematic of single line analog SLIC board - two wire repeaters - Electronic private automatic branching exchange - basic block schematic - Power line communication: block schematic explanation - Facsimile - FAX transmitter and receiver.

References

2. Electronic communication: Roody and Coolen- PHI.
5. Telephony and Carrier current engineering: P N Das.
6. Modern communication Systems: Couch- PHI.

ELECTRONIC CIRCUITS - II

Module 1
High frequency equivalent circuit of a transistor. Hybrid pi model - explanation of components - r parameters in terms of h parameters - Tuned amplifiers - principle - single tuned and double tuned amplifiers - frequency response - applications (no analysis) - multistage amplifiers - frequency response.

Module 2
Feedback - different types - positive, negative, voltage, current, series and shunt feedback - Feedback in amplifiers - its effect on amplifier performance - typical
feedback arrangements - emitter follower - darlington emitter follower - cascade amplifier (principles only) - difference amplifier.

Module 3
Oscillators - conditions for oscillation - analysis and design of RC phase shift oscillator, general form of oscillator circuit - working of Hartley, Colpitt's, Crystal, tuned collector and Wien Bridge oscillators.

Module 4

Module 5
Large signal amplifier - harmonic distortion - analysis of class A, class B, class C and class D amplifiers - complimentary and symmetry stage - sweep generators - voltage and current sweeps - time base generators - linearisation - miller and bootstrap sweeps - applications.

References

2. Integrated electronics - Millman & Halkias, Mc Graw Hill
3. Electronic principles - Malvino
4. Electronic devices and circuits - Bugart
Module 1

Module 2
Fourier Analysis of Continuous Time Signals and Systems - Fourier Series- Fourier Transform and properties- Parseval’s theorem- Frequency response of LTI systems. Sampling Theorem.

Module 3
Fourier Analysis of Discrete Time Signals & Systems - Discrete-Time Fourier series- Discrete-Time Fourier Transform (including DFT) and properties. Frequency response of discrete time LTI systems.

Module 4

Module 5

References
RELIABILITY AND HUMANITIES

Module 1
Concepts of reliability: Definition of reliability- failure- classification of failures- measures of reliability- failure rate- mean time between failures (MTBF)- mean time to failure (MTTF).

Module 2
Failure pattern and fitting curves: Graphical plots- Bath tub curves- Hazard models- Constant hazard models- Linearly increasing hazard model- Weibull model.

Module 3
Manufacture for Quality and reliability: The need for prototype tests- the quality standard- planning to achieve required quality- basic concepts of sequencing.

Module 4
Control charts in statistical quality control: statistical quality control advantages- types of control charts- X and R chart- P chart- C chart- Re-engineering- Zero defects.

Module 5
Human relations: Human Behavior- Scope of Industrial psychology-Theories of Motivation-Handling of workers grievances-Workers participation in management-Industrial discipline-Industrial disputes-Industrial fatigue-Wages and incentives.

References

1. Reliability Engineering: L S Sreenath.
3. Industrial Engineering & Management: Banga and Sharma.

ELECTRONIC CIRCUITS LAB
List of experiments

1. Power amplifiers: Design of class A and class AB push pull stage – verification of power output.
2. IC power amplifier.
5. Design of bootstrap sweep generator.
7. SCR, Triac firing circuits.
8. Feedback amplifier, design of two stage RC coupled amplifier.
9. Tuned amplifiers.
10. Design and testing of DC regulated power supplies (Fixed and variable).
11. Simulation of above circuits using PSPICE.

Note
New experiments may be added in accordance with subject LA 404

COMPUTER PROGRAMMING LAB

LA 408 0+0+4

Part 1

1. Computer hardware familiarization.
2. Familiarization of MS-DOS commands, Microsoft Windows.

Part 2

Programming Experiments in C/C++: Programming experiments in C/C++ to cover control structures, functions, arrays, structures, pointers and files, classes, operator & function overloading, inheritance, polymorphism.
Module 1

Module 2

Module 3

Module 4

Module 5

References
6. Complex variables and applications - Churchill and Brown, McGraw-Hill.
7. Operations research - Panneer Selvam, PHI.

POWER ELECTRONICS

LA 502 2+1+0

Module 1

Module 2
AC to DC Converters - Operation and analysis of Single phase and multi-phase uncontrolled and controlled rectifiers with R, RL and back EMF load- effect of source inductance- free wheeling effect- power factor improvement methods for phase Controlled rectifiers- filters. PWM chips: SG3524 and TL 494- Block schematic.

Module 3
AC to AC Voltage Converter - Operation and analysis of single phase integral cycle and phase controlled converters- Configuration of three phase controllers.

Module 4
DC to DC Converters - Chopper classification- Step down- step up and four quadrant converters operation- analysis and control with R, RL and EMF load- current and voltage Commutation circuits.

Module 5
DC to AC Converters - Single phase and three phase bridge inverters- VSI and CSI- voltage control - PWM & Square wave operation- Harmonics and their reduction techniques.

References
3. Thyristors and Applications: Ramamoorthy.
4. Power Electronics: Converter, Applications and Design, Mohan Ned, John Wiley,

APPLIED ELECTROMAGNETIC THEORY

L 503

Module 1


Module 2


Module 3

**Maxwell’s equations and travelling waves**: conduction current and displacement current- Maxwell’s equations- Plane waves- Poynting theorem and Poynting vector- Plane electromagnetic waves- Solution for free space condition-
Uniform plane wave-wave equation for conducting medium- Wave polarization- Poisson’s and Laplace equations.

Module 4
Guided waves between parallel planes- transverse electric and transverse magnetic waves and its characteristics- Rectangular wave guides- modes of propagation.

Module 5
Transmission lines -Transmission line equations- transmission line parameters- Skin effect- VSWR- Characteristic impedance- Stub matching- Smith chart - Phase velocity and group velocity.

References


COMPUTER ORGANISATION AND ARCHITECTURE
LA 504 2+1+0

Module 1
Basic structure of computer hardware and software- addressing methods and machine programming sequencing- different addressing modes- instruction sets- computer arithmetic logic design- fast adders- multiplication- Booth’s algorithm- fast multiplication- integer division- floating point numbers.

Module 2
Control unit- instruction execution cycle- sequencing of control signals- hardwired control- PLAs- micro programmed controls- control signals- micro
instructions - Micro program sequencing- branch address modification- prefetching of micro instructions.

Module 3

Module 4

Module 5
Introduction to parallel processing and architecture- classification- array processors- pipeline architecture- interconnection- networks- multistage networks- message passing architecture.

References
3. Computer organization and Design – Pal Choudhary
Module 1
Introduction to operational amplifiers – Basic differential amplifier - dual input balanced output and unbalanced output- Internal block schematic of op amp - Pin identification- power supply requirements - typical data sheet - Op-amp parameters - ideal op amp - transfer curve - equivalent circuit- open loop configurations - frequency response of op amps - compensating networks - slew rate and its effect.

Module 2
Op amp in closed loop configuration: Different feed back configurations- Voltage series feedback and voltage shunt feedback - concept of virtual ground- voltage follower - V/I converters and its applications - Differential amplifiers with one op amp and 3 op amps- Use of offset minimizing resistor (R_{OM}) and its design.

Module 3

Module 4
Filters and timers: LPF- HPF- BPF- Notch and all pass filters- I order and II order filters- Switched capacitor filter- Switched capacitor integrator. 555 timers – Functional block diagram- Astable multivibrator, monostable multivibrator and its applications.

Module 5

References
2. Op amps and Linear Integrated circuits: R F Coughlin- Pearson Education.
5. Integrated circuits: K R Botkar
Module 1

Module 2
Atmel AT89C51 microcontroller – features - pin configurations - internal block schematic - pin descriptions - PORT0, PORT1, PORT2, PORT3, idle & power down mode - power control register - program protection modes - flash programming & verification.

Module 3
Memory organization - program memory - data memory - direct & indirect addressing area - Program status word - register banks - addressing modes - instruction set – arithmetic - logical and data transfer instructions - Boolean instructions - program branching instructions - Programming examples.

Module 4

Module 5
Timer0 & Timer1 - TMOD SFR - mode0, mode1, mode2, mode3 - TCON SFR - serial interface - SCON SFR - mode0, mode1, mode2, mode3 - block schematics- baud rates- power on reset circuit- ONCE mode- on chip oscillator- external
program & data memory timing diagrams - I/O port timings – programming examples.

References

2. The 8051 Microcontroller: Kenneth J Ayala, Penram International
3. Microprocessors and Architecture: Ramesh S Goankar
4. Microcomputers and Microprocessors: John Uffenbeck, PHI
5. Web site of Atmel - www.atmel.com

DIGITAL IC LAB

LA 507 0+0+4

List of experiments

1. TTL & CMOS characteristics (7400, CD4001)
2. Interfacing of TTL & electromagnetic relay using transistor, opto coupler (4N33) & Darlington arrays (ULN2803).
3. Logic family interconnection (TTL to CMOS & CMOS to TTL)
4. Design of half adder & full adder using gates.
5. Design and testing of ripple & synchronous counters using JK flip flops (7473, 7476)
6. Counters using shift registers (Ring counter & Johnson counter).
7. Study of counter ICs (7490, 74190).
9. Design of mono-shots using dedicated ICs (74123).
10. Logic design using multiplexers (74150).
11. Logic design using decoders (74138).
13. Design of 7 segment display circuits-static/dynamic (7447, FND542).
14. PRBS generator.
15. Digital circuit simulation using electronic work bench/ similar working tools.
Note
Any experiment related to LA402 may be added to the above list.

COMMUNICATION - I LAB
L 508 0+0+4

List of experiments

2. Amplitude modulation.
3. Frequency modulation.
4. PWM using SG3525.
5. 555 Applications
6. 566 Applications
7. Study of 565 and its applications
8. Crystal oscillator
9. Oscillators using OP-AMP
11. Multiplexing using analog multiplexer IC’s.

Note
Any other experiments may be added to the above list related to LA403.

SIXTH SEMESTER
INDUSTRIAL MANAGEMENT & ECONOMICS
LA 601 3+2+0

PART A: INDUSTRIAL MANAGEMENT

Module 1
Modern concept of Management: Scientific management-Functions of management-Planning-Organising- Staffing-Directing- Motivating-

Module 2

Module 3
Marketing Management: Pricing- Promotion- Channels of distribution- Market research- Advertising. Production Management: Batch and mass production- Inventory control- EOQ-Project planning by PERT/CPM- Construction of Network (Basic ideas only).

PART B: ECONOMICS

Module 4

Module 5

References

3. Marketing Management - Philip Kotler, PHI
4. Indian economy - A.N. Agarwal, Wishwa Prakashan
Module 1

**Random Signal Theory:** Review of discrete and continuous random variables- Gaussian probability function- properties- error function- complementary error function. Base band data transmission: - Base band binary data transmission system- Inter symbol interference- Nyquist pulse shaping criteria- Optimum transmitting- Receiving filters.

Module 2

**Correlative coding:** -Duobinary Base band PAM system- Use of controlled ISI- M-ary signaling scheme (no analysis)- Binary versus M-ary signaling schemes- pre coding- Bipolar coding- Manchester coding- HDB coding- Equalization- Adaptive equalization- Eye pattern- Scrambler- Unscrambler.

Module 3

**Digital transmission:** - BPSK- DPSK- M-ary PSK- QPSK- BFSK- M-ary FSK- MSK- comparison.

Module 4

**Digital transmission of Analog signals:** - Sampling - Quantizing uniform non-uniform quantization -Companding- A law μ law PCM system- DPCM delta modulation system- slope over loading- ADM- CVSD- Quantization noise.

Module 5

**Noise in communication system:** - Noise types- SNR- Probability of error- Effective Noise temperature- Noise figure- Detection of binary signals in Gaussian noise: -Maximum likelihood Receiver structure- Matched filter- Correlation realization of matched filter- optimizing error performance- error probability performance of binary transmission system.

References

1. Digital Communications: Sklar, Pearson Education
Module 1


Module 2


Module 3

**Discrete Fourier Transform:** Properties - Circular convolution - Linear Convolution using DFT - relation between Z-Transform and DFT - Fast Fourier Transform; decimation – in time and Frequency - FFT algorithms – General Computation using Radix 2 algorithm.

Module 4

**Finite word length effects in digital filters:** Introduction - Number Representation - Fixed Point - Sign-Magnitude - One’s-complement - Two’s-complement forms - Addition of two fixed point numbers - Multiplication in Fixed Point arithmetic - Floating point numbers - Block floating point numbers - quantization - truncation - rounding - effects due to truncation and rounding - Input quantization error - Product quantization error - Co-efficient quantization error - zero-input limit cycle Oscillations - Overflow limit cycle Oscillations - Scaling - Quantization in Floating Point realization IIR digital filters - Finite Word Length Effects in FIR Digital Filters - Quantization effects in the Computation of the DFT - quantization errors in FFT algorithms.

Module 5

References

2. Desecrate time signal processing: Oppenhiem- Pearson edn.
3. Digital signal processing: Oppenhiem and Sheffer- PHI
4. Introduction to Digital signal processing: Johny R Johnson
5. Digital signal processing: Proakis and Manolakis.

RADIATION & PROPAGATION

Module 1
Retarded potentials: Radiation from an A.C current element monopoles and dipoles-power radiated from a dipole isotropic radiators- radiation pattern-radiation intensity-directive gain-power antenna efficiency-effective area-effective length and aperture-Reciprocity theorem-radiation resistance-antenna beam width.

Module 2
Antenna array: Classifications-Broad-side, End-fire arrays, Array of n-point, two point sources, multiplication of patterns -binomial array-stacked array folded dipole- reflector-Basic principles of antenna-parabolic reflector different methods- Chebyshev arrays- super directive arrays.

Module 3

Module 4
Factors involved in the propagation of radio waves: the ground wave-Reflection of radio waves by the surface of the earth-space wave propagation-considerations in space wave propagation-atmospheric effects in space wave propagation-ionosphere and its effects on radio waves -mechanism of ionosphere propagation-refraction and reflection of sky waves by ionosphere-ray paths-skip distance-maximum usable frequency-vertical and oblique incidence-fading of signals - selective fading-diversity reception, Duct Propagation.

Module 5

References
1. Antennas and wave propagation - K. D. Prasad
3. Antenna theory and design- A. Ballanis
potentiometric, inductive (self generating and non self generating type),
capacitive, piezo electric, strain gauge, ionization and mechano electronic type.
Opto electrical type-photo emissive, photo conductive and photo voltaic type.
Frequency generating type-digital encoders-selection criteria for transducers.

**Module 3**
Intermediate elements-instrumentation amplifier, isolation amplifier. Data
transmission elements-block diagram of telemetering system-classification of
telemetering system-Electrical telemetering system--voltage, current and position
type-RF telemetery-pulse telemetery (analog and digital)-pulse amplitude, pulse
frequency, pulse duration and pulse position modulation.

**Module 4**
Bridge measurements - Wheatstone bridge - guarded Wheatstone bridge. AC
bridges - Owen's bridge - Shering Bridge - Wein Bridge - Wagner ground
connection. Recording techniques-strip chart recorders-basic principles of digital
recording. Basic principles of Signal Analyzers-Distortion analyzer wave
analyzer, spectrum analyzer.

**Module 5**
Basic measurements - Strain measurement - Pressure measurement - Flow
measurement - Temperature measurement - Force & torque measurement.
Multiplexing - D/A multiplexing and A/D multiplexing.

**References**

1. Measurement Systems - Doeblin, MGH.
2. Instrumentation-devices and systems - Rangan, Sarma & Mani, TMH.
3. Principles of Measurement & Instrumentation – Morris, PHI.
4. Transducers & Instrumentation – D.U. S Murthy, PHI.
Introduction to control system – Basic idea of control systems and their classifications – transfer function – transfer function of electrical, mechanical and electromechanical system – block diagram – signal flow graph – Mason’s gain formula.

Module 2

Module 3

Module 4

Module 5

References
1. Modern control engineering – Katsuhiko Ogata, Pearson Edn
2. Control systems principles and design: M. Gopal, TMH.
3. Automatic control system – B.C. Kuo, PHI.
4. Control system design: Graham C Goodwin, PHI.
5. Modern Control Systems: Dorf, Pearson Education.
LINEAR IC LAB

L 607 0+0+3

List of Experiments

1. Measurement of op amp parameters.
2. Active filters: LPF, HPF, BPF, All pass & notch filters.
3. Square wave, Triangular, Saw tooth generation using op amp.
4. Logarithmic amplifiers.
5. Precision rectifiers.
7. Sample and hold circuit.
8. 8038 function generators.
9. Analog to digital converters.
10. Digital to analog converters.

Note
Any experiment related to L505 may be added to the above list.

MINI PROJECT

L 608 0+0+3

The mini project will involve the design, construction, and debugging of an electronic system approved by the department. There will be several projects such as intercom, SMPS, burglar alarm, UPS, inverter, voting machine etc. The schematic and PCB design should be done using any of the standard schematic capture & PCB design software. Each student may choose to buy, for his convenience, his own components and accessories. Each student must keep a project notebook. The notebooks will be checked periodically throughout the semester, as part of the project grade.

In addition to this, the following laboratory experiments should also be done in the lab.

1. Astable and mono stable multi-vibrators using 555
2. Light activated alarm circuit
3. Speed control of electric fan using triac
4. Illumination control circuits
5. Touch control circuits
7. Schematic capture software (OrCAD or similar) familiarization.
8. PCB design software (OrCAD Layout or similar) familiarization.
A demonstration and oral examination on the mini project also should be done at the end of the semester. The university examination will consist of two parts. One of the lab experiments will be given for examination to be completed within 60 to 90 minutes with a maximum of 30% marks. 70% marks will be allotted for the demonstration and viva voce on the mini project.
SEVENTH SEMESTER

MICRO-CONTROLLER BASED SYSTEM DESIGN

LA 701  2+1+0

Module 1

Module 2

Module 3
Analog to digital converters- single slope, dual slope, successive approximation, sigma delta, flash – comparison - typical ICs - A/D interface – digital to analog converters – different types – D/A interface - optically isolated triac interface-design of a temperature control system- interfacing programs using C and assembly language.

Module 4

Module 5
References

3. Digital fundamentals: Floyd, Pearson Education.
4. Programming and customizing the 8051 C: Myke Predko, TMH.
5. Programming with ANSI C and turbo C: Kamthane, Pearson Education.
6. Microcomputers and Microprocessors: John Uffenbeck, PHI.

VLSI TECHNOLOGY

Module 1

Module 2

Module 3
CMOS technology: Metal gate and silicon gate- oxide isolation- Twin well process- Latch up- BiCMOS technology- fabrication steps- circuit design process- stick diagrams- design rules- Capacitance of layers- Delay- Driving large capacitance loads- Wiring capacitance- Basic circuit concepts- scaling of MOS structures- scaling factors- effects of miniaturization.

Module 4
Subsystem design and layout- Simple logic circuits- inverter, NAND gates, BiCMOS circuit, NOR gates, CMOS logic systems - bus lines- arrangements- power dissipation- power supply rail distribution- subsystem design process- design of a 4 bit shifter.
Module 5

Gallium Arsenide Technology: Sub-micro CMOS technology- Crystal structure- Doping process- Channeling effect- MESFET- GaAs fabrication- Device modeling.

References

1. Modern VLSI design: Wolf, Pearson Education.
3. Basic VLSI design: Douglas Pucknell, PHI.
7. Introduction to VLSI: Conway, Addison wesley.

MICROWAVE AND RADAR ENGINEERING

Module 1


Module 2


Module 3

Module 4
Radar range equation- Block schematic of pulse radar- Radar frequencies-
Applications of radar- CW radar- applications of CW radar- CW radar with

Module 5
Direction finders- Instrument Landing System- Radio ranges. Navigation-
Hyperbolic navigation- LORAN. Satellite navigation- Doppler navigation - Global
positioning system- Different types of microwave antennas-basic principles.

References
1. Microwave devices and circuit: Samuel Liao, PHI.
4. Introduction to radar systems — Merrill I Skolnik, McGraw Hill.
Module 4
Basic optical communication systems- point-to-point link- rise time budget-protection techniques- WDM – transceiver requirements-TDM- optical amplifiers- SOAs – EDFAs- optical receivers- Introduction to optical fibre networks.

Module 5
OTDR - Measurements- numerical aperture- dispersion measurements- refractive index profile measurements- band width measurements- fibre attenuation measurements- cutoff wave length measurements- applications of fibre optic systems- future developments

References
1. Fibre optic communication technology: Djafer K Mynbaev, Pearson Education.
2. Electronic communication: Dennis Roddy & John coolen, PHI.
3. Optic fibre communication: John M senior, PHI.
5. Optical communication system: John Gower, PHI
7. Optical fibre and fibre optic communication: Subir Kumar Sarkar, S Chand & co. Ltd

INFORMATION THEORY AND CODING

L 705 3+1+0

Module 1
Information theory: - Concept of amount of information -units, Entropy - marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

Module 2
Discrete channels: - Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem. Continuous channels: - Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Trade off between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

Module 3

Module 4
Codes for error detection and correction: - Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes: - Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

Module 5

References
5. Digital Communications Fundamentals and Applications: Bernard Sklar, Person Education Asia
Module 1  Classical optimization techniques
Single variable optimization – Multivariable optimization with no constraints –
Hessian matrix – Multivariable saddle point – Optimization with equality
constraints – Lagrange multiplier method - Multivariable optimization with
inequality constraints – Kuhn-Tucker conditions.

Module 2  One-dimensional unconstrained minimization
Elimination methods – unrestricted search method – Fibonacci method –
Interpolation methods – Quadratic interpolation and cubic interpolation methods.

Module 3  Unconstrained minimization
Gradient of a function – Steepest descent method – Newton’s method – Powells
method – Hooke and Jeeve’s method.

Module 4  Integer - Linear programming problem
Gomory’s cutting plane method – Gomory’s method for all integer programming
problems, mixed integer programming problems.

Module 5  Network Techniques
Shortest path model – Dijkstra’s Algorithm – Floyd’s Algorithm – minimum

References

2. Optimization Concepts and applications in Engineering: A. D. Belegundu,
   T.R. Chandrupatla, Pearson Education Asia.
   McLeavey, R. Mojena, Richard D. Irwin, INC.
5. Operations Research: R. Panneerselvam, PHI
OBJECT ORIENTED PROGRAMMING IN C++ (ELECTIVE - I)
LA 706-2                       3+1+0

Module 1
Introduction to loops: Evolution of object oriented languages - Support for experiments and structure - process of language translation – Need of objects - Definition of Object - Oriented Language.

Module 2
Encapsulation & Inheritance: Building classes - Declaring objects Member functions - constructors and destructors members access control.

Module 3
POLYMORPHISM - Virtual functions - Defining virtual functions – Usage of virtual functions - Abstract classes - simulation using abstract classes.

Module 4
OVERLOADING: Overloading functions - Overloading operators to provide new meaning - Selecting Friend or Member Functions for Operator Overloading.

Module 5
DYNAMIC OBJECTS: Dynamic object allocation - Using references with dynamic memory allocation - Inline functions outside class definitions - Friend functions, Applications - Object oriented databases case study – some language (Simula, Smalltalk, C++, Ada) features.

References
2. Object oriented programming using C++: Pohl, Pearson Education.
3. Object oriented programming with C++: E. Balaguruswamy, TMH.

NEURAL NETWORKS (ELECTIVE - I)

L 706-3 3+1+0

Module 1

Module 2

Module 3
Counter Propagation networks: Kebenon layer - Training the cohenen layer - Pre initializing the wright vectors - statistical properties - Training the Grosbery layer - Full counter propagation network - Application.

Module 4
Statistical methods- Boltzmann’s Training - Cauche training - Artificial specific heat methods - Applications to general non-linear optimization problems.

**Module 5**


**Text Book**

Neural Computing Theory & Practice - Philip D. Wasserman.

**References**

1. Neural Networks - Simon Haykins, Pearson Education.
2. Adaptive Pattern Recognition & Neural Networks - Pay Y.H.
3. An Introduction to neural computing - Chapman & Hall
5. Artificial Neural Networks - B.Yegnanarayana, PHI

**BIOMEDICAL ENGINEERING (ELECTIVE - I)**

L 706-4 3+1+0

**Module 1**

Module 2


Module 3

**Ultrasonic measurements:** Characteristics of Ultrasound- Attenuation- Doppler effect- basic modes of transmission- pulsed, continuous, pulsed Doppler- Ultrasonic imaging- Block schematic of A mode, B mode, M mode instruments- Electronic scanners: Linear and Phased array- Applications of Ultrasound: Gynecology and obstetrics- blood flow measurements- cardiac imaging- echocardiography- echoencephalography.

Module 4

**X ray imaging and measurements:** x ray generation- x ray machine- C arm machine- image intensifiers- x ray films- photographic imaging- Fluoroscopy- computed tomography- CAT scan: block schematic- Gantry- detectors.

Module 5

**Bio-telemetry:** components in telemetry system- transmitter-receiver- pulse modulators- implantable units- applications. Intensive care unit: Planning and location of different instruments- Bedside monitors- Prosthetic instruments- artificial heart- pump oxygenators- hemodialysis- artificial kidney- different dialysers. Electrical safety: Physiological effects of electric current- let go current- shock hazards- need of grounding- isolation of patients- isolated power distribution system.

References

1. Introduction to biomedical technology: Joseph J Carr, Pearson Edn.
2. Biomedical Instrumentation & Measurements: Leslie Cromwell, PHI.
PRINCIPLES OF REAL TIME SYSTEMS (ELECTIVE - I)

LA 706-5

Module 1
Introduction to Real Time Systems – Structure of real time systems, real time computer, task classes – Periodic, Aperiodic, critical, Non-critical, definition of real time systems – real time systems, embedded systems - Hard real time systems, soft real time systems, real time design issues.

Module 2

Module 3

Module 4

Module 5
Programming Languages – Desired language characteristics, Real time databases, characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

Text Book
Real Time Systems  - C.M Krishna, Kang G. Shini (McGraw Hill)

References
1. Real Time Systems, Design & Analysis  - Philip Laplante (IEEE)
2. Familiarization of 8085 trainer kit, manual code entry, simple examples.
3. Design and construction of a simple flash programmer for 89C51/89C2051 C.
4. Study of Intel Hex file format.
5. Use of assembler, linker and simulator for 89C51/89C2051.
7. Programming examples using Embedded ‘C’ compiler for 89C51/89C2051.
9. Design and construction of the following interfacing modules.
   a) A/D converter.
   b) D/A converter.
   c) Alphanumeric LCD display.
   d) Matrix keyboard interface.
   e) Seven segment display.
   f) Extending I/O port using shift registers(74HC595, 74HC165).
   g) Stepper motor.
   h) Infra red transmission and reception.
   i) Opto isolated I/P and O/P.
   j) Serial EEPROM.
   k) Real time clock.
   l) Interfacing using RS 232 and printer port.

Note
Any other embedded processor with similar or better capability may be used instead of 89C51/89C2051.
1. Microwave measurements - VSWR, wavelength, Attenuation, Impedance.
2. Antenna Measurements - Gain, Directivity, Radiation Pattern of various types antennae.
5. Study of optical fibers and optical communication systems.
6. Delta modulation, PCM, PAM, PPM, PWM, ASK, PSK.
7. Experiments of Satellite communication system.
8. Display systems.
9. Study of PLC’s.
10. Familiarization of Digital modulation and demodulation Trainer Kit.
Module 1

Module 2
MODEMS - serial communication standards - X-21 digital interface - Need for data link layer - stop and wait and sliding window protocol - HDLC - terminal handling - polling - multiplexing - concentration - virtual circuit and data-grams - routing - congestion control.

Module 3

Module 4
Session layer - design issues - data exchange - dialogue management - synchronization - remote procedure call - client server model - Presentation layer - data presentation - compression - network security - privacy - cryptography - presentation layer in ARPANET.

Module 5
Application layer - virtual terminal - file transfer protocol - E-mail - introduction to distributed system - ATM protocol architecture - ATM logical connections - ATM cells - cell transmission - ATM adaptation layer - AAL protocols - basic principles of SDH and SONET.

References
ADVANCED COMMUNICATION SYSTEMS

Module 1

Module 2

Module 3

Module 4

Module 5
Spread spectrum Techniques and remote sensing- Pseudo noise sequences –time hopping-frequency Hopping – Robustness – Fast and Slow hopping – Hybrid & Chirp spread spectrum- Synchronization – acquisition – Tracking - Concepts of
Jamming – Analysis of DS/SS – Analysis of avoidance-generation of signals-detection – Applications.

References

1. Electronic communication system fundamentals: Wayne Tomasi, Pearson Education.
2. Wireless communication principles and practice: T S Rappaport, Pearson Education.
3. Satellite communication: Gagliardi.

ADVANCED MICROPROCESSORS

LA 803

Module 1
Intel 8086 Microprocessor - Internal architecture – Block diagram – Minimum and maximum mode operation – Interrupt and Interrupt applications – DMA data transfer – 8087 math coprocessor. 8086 memory organization – even and odd memory banks – segment registers – logical and physical address – advantages and disadvantages of physical memory.

Module 2
Addressing modes used in 80x86 family - Data addressing mode – register addressing, immediate addressing, direct addressing, register indirect addressing, base plus index addressing, register relative addressing, base relative plus index addressing, scaled addressing. Program memory addressing modes - direct program memory addressing, relative program memory addressing. Stack memory addressing mode.

Module 3
Intel 80286 Microprocessor - 80286 Architecture, system connection – Real address mode operation – Protected mode operation.

Module 4

Module 5

References
2. Microprocessor and Interfacing 2nd Edition Douglous V. Hall TMH
3. The 80x86 family John Uffenbeck
low level modulation and its comparison. Colour TV picture tubes: purity and convergence, Delta gun, PIL, Trinitron tubes, LCD screens.

Module 3
**Monochrome and colour reception, Monochrome receiver:** Detailed block schematic, Yagi antenna, BALUN transformers, RF tuner, electronic tuning, SAW filters, IF conversion, VSB reception and correction, video detector, AGC: delayed AGC and Keyed AGC, video amplifier, cathode and grid modulation, sync separation, horizontal and vertical deflection circuits and wave forms, sound separation. Power supplies: SMPS and block schematic explanation, EHT generation and its wave form description, Typical ICs in different stages.

Module 4
**Colour Television:** Compatibility consideration, Colour response of human eye, Three colour theory, additive mixing of colours, chromaticity diagram, Luminance and chrominance, colour difference signal and its generation, Polarity of colour difference signal, Frequency interleaving and Colour burst signal, delay lines, Basic colour television systems: PAL and NTSC, Block schematic explanation.

Module 5
**Television applications:** CCTV and its functional block schematic, Cable television: converters, cable connections, Satellite television: Dish antenna, LNB, Down converters, Video discs: VCD and DVD, Digital recording, LASER source, High definition television.

References


ADVANCED MATHEMATICS (ELECTIVE - II)
CMELRT 805-1
3+1+0

Module 1
**Green’s Function**
operator – Green’s function – initial value problems – boundary value problems – simple cases only

Module 2 Integral Equations
Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green’s function – solution of Fredholm integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

Module 3 Gamma, Beta functions

Module 4 Power Series solution of differential equation
The power series method – Legendre’s Equation – Legendre’s polynomial – Rodrigues formula – generating function – Bessel’s equation – Bessel’s function of the first kind – Orthogonality of Legendre’s Polynomials and Bessel’s functions.

Module 5 Numerical solution of partial differential equations.
Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson’s equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

References
7. Principles and Techniques of: Bernard Friedman, John Wiley and sons
   Applied Mathematics
   co
Module 1

Module 2

Module 3

Module 4

Module 5
Advanced Features: Entity Statements- Generate Statements- Aliases- Qualified Expressions- Type Conversions- Guarded Signals- Attributes- Aggregate Targets- Shared Variables- Groups - Model Simulation: Simulation- Writing a Test Bench- Converting Real and Integer to Time- Dumping Results into a Text File- Reading Vectors from a Text File- A Test Bench Example- Initialising a Memory- Variable File Names- Hardware Modelling Examples: Modelling Entity interfaces- Modelling Simple Elements- Different Styles of Modelling-

**Text Book**

VHDL Primer Third editions: J. Bhasker, Pearson Education Asia.

**References**

1. Introducing VHDL from simulation to synthesis: Sudhakar Yalamanchilli, Pearson Education Asia

**MEDICAL ELECTRONICS (ELECTIVE - II)**

**Module 1**


**Module 2**


**Module 3**

Module 4

Module 5

References
1. Introduction to Biomedical equipment technology: J J Carr, Pearson Education.
2. Biomedical Instrumentation: John G Webster, Mifflin Hougton Co.
4. Biomedical Instrumentation: R S Khandpur, TMH

ADVANCED MICRO-CONTROLLERS (ELECTIVE - II)
LA805-4
3+1+0

Module 1

Module 2

Module 3
National semiconductor COP8 family - COP8CBR9 processor – features – electrical characteristics – pin descriptions – memory organization –EEPROM -
security – brownout reset – in system programming – boot ROM. Idle timer – Timer1, Timer2, Timer3 -operating modes – PWM mode – event capture mode

**Module 4**

**Module 5**

**References**

1. Design with PIC micro-controllers: John B Peatman, Pearson Education.
5. Atmel semiconductor web site – www.atmel.com
7. Microchip semiconductor web site – www.microchip.com
Framework for Electronic Commerce - WWW as the Architecture- Hypertext publishing.

Module 2

Module 3
Electronic Payment Systems - Types of Electronic Payment Systems - Digital Token Based Electronic Payment System - Smart Cards - Credit Cards - Risk in Electronic Payment Systems - Designing Electronic Payment Systems.

Module 4

Module 5

Text Book
Frontiers of Electronic Commerce: Ravi Kalakota & Andrew B Whinston, Pearson Education.

References
2. E- Commerce The cutting edge of Business: Kamlesh K Bajaj & Debjani Nag.
3. E-Commerce: Strategy Technologies and Applications, TMH.
ADVANCED DIGITAL SIGNAL PROCESSING (ELECTIVE - III)
LA806-1 3+1+0

**Module 1**

**Module 2**

**Module 3**

**Module 4**

**Module 5**

**References**
2. Theory and Applications of DSP: L.R Rabiner and B gold
4. Wavelets and Subband Coding: Valterli & Kovaceric, PHI.

MULTIMEDIA SYSTEMS (ELECTIVE - III)

Module 1
INTRODUCTION: Definition of multimedia, multimedia, hardware, software applications and software environments - Media Types - Analog and digital video, digital audio, music and animation - Analog & Digital video - Memory storage - Basic tools - Authoring tools.

Module 2
BUILDING BLOCKS: Text - Hyper text - Sound - Sound cards - Standards - Image - Image types - Image compression, RLE, JPEG, MPEG - Fractal and Wavelet Compressions - Image file types - Animation - Capture and Playback techniques. (basic ideas only)

Module 3
MULTIMEDIA ENVIRONMENTS: The Compact Disc family, CD-interactive, Digital Video Interactive, QuickTime, Multimedia PC and Microsoft Multimedia Extensions.

Module 4
MULTIMEDIA PROGRAMMING: Framework: Overview, Media classes, Transform classes, Format classes and Component classes - Problems related to programming - Composition, Synchronisation, Interaction, Database integration.

Module 5
References

3. Authoring Interactive multimedia - Arch C Luther
4. Optimizing your Multimedia PC - L.J. Skibbe, Susan Lafe Meister - Comdex
5. Multimedia Bible - Winn L. Rosch, Sams
6. Multimedia Producers Bible - Ron Goldberg, Comdex
9. Integrated Multimedia Systems - Palikom, The communication Wall Overview
Processor Management: CPU scheduling - scheduling algorithms, Multiprocessor scheduling, Process management in UNIX, concurrent process-critical section, semaphores, synchronization, concurrent languages.

Module 5
Memory Management: swapping, partitions, paging, segmentation, virtual memory concepts, page replacement, dynamic linking, caching of secondary storage, memory management in UNIX, Deadlocks: cause, detection, prevention, avoidance, recovery, combined approach to deadlock handling.

References
1. System programming and Operating Systems – D M Dhamdhere
3. Operating System – Peterson & Silberschatz, Addison Wesley
4. Operating Systems – Dietal H M
5. Design of UNIX Operating System – Maurice J Bach
6. UNIX System Programming – Stevens.
Module 2


Module 3


Module 4


Module 5


Text Book

Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech

Reference

DIGITAL IMAGE PROCESSING (ELECTIVE - III)

Module 1

Module 2

Module 3
Image Enhancement - Point processing - Histogram modeling & Equalization - Spatial Filtering - Filtering in the frequency domain - color Image processing.

Module 4
Image Restoration - Degradation model - Inverse filtering - Wiener Filter - Interactive restoration - Image analysis & vision - basic principles only.

Module 5

References
2. Fundamentals of digital image processing: Jain Anil K, PHI.

SYSTEMS LAB

1. Experiments based on Matlab.
   a. To test linearity, causality & stability of LTI system.
   b. To find DFT of a given sequence using DIT & DIF FFT algorithms.
   c. To find IFFT of a given sequence using DIT & DIF FFT algorithms.
d. Program to design IIR filter using Bilinear transformation impulse invariant methods.
e. Control system simulation experiments.
f. Programs to design filters using window techniques.

2. Digital signal processing based on DSP processors.
3. Familiarization of PAL assembler.
4. Realization of combinational and sequential circuits using PAL.
5. Realization of simple digital circuits using VHDL.
6. Familiarization of FPGA trainer kits.
7. Realization of digital circuits using FPGA.

Note
Any other experiments may be added in accordance with the electives offered.

**L 709 / 808  PROJECT DESIGN AND SEMINAR  0+0+2**

Each student is required to present a technical paper on a subject approved by the dept. The paper should in general reflect the state of the art. He / she shall submit a report on the paper presented to the department. In addition to the seminar he / she shall undertake a project work (as a team or individually) in the 7th semester itself in consultation with the guide (s), panel of staff members, and submit a report of the project work done to the department.

**VIVA - VOCE**

**L 809**

A comprehensive Viva - voce examination will be conducted to assess the student's overall knowledge in the specified field of engineering. At the time of viva - voce, certified reports of seminar and project work are to be presented for evaluation.