Scheme & Syllabi for Electronics and Instrumentation Engineering B.Tech Degree Course (Semester 3 to 8) of Mahatma Gandhi University (2002-2003 admission)

SCHEME FOR ELECTRONICS & INSTRUMENTATION ENGINEERING
B.TECH DEGREE COURSE OF M G UNIVERSITY

Semester	Subject No.	Subject	
3	301	Engineering Mathemetics-II	
	302	Network Theory	
	303	Electrical Technology	
	304	Solid State Devices	**University**
	305	Electronics Circuits-I	**prescribed**
	306	Computer Programming	**Scheme &**
	307	Electrical Lab	**Syllabi common**
	308	Basic Electronics Lab	**with Electronics**
4	401	Engineering Mathemetics-III	**& Communication**
	402	Digital Electronics & Logic Design	**Engineering**
	403	Communication Engineering-I	**already exist**
	404	Electronic Circuit-II	**for the 3rd and**
	405	Signals & Systems	**4th Semesters**
	406	Reliability & Humanities	
	407	Electronic Circuits Lab	
	408	Computer Programming Lab	

NEW PROPOSED SCHEME FOR V TO VIII SEMESTERS

Semester	Subject No.	Subject	Page No.
5	CMELPAS 501	Engineering Mathematics-IV	2
	S502	Electronic Instrumentation	3
	S503	Transducer Engineering	4
	S504	Control Systems I	5
	LAS 505	Linear Integrated Circuits	6
	LS 506	Microprocessors & Microcontrollers	7
	S 507	Linear & Digital IC Lab	8
	S 508	Transducers & Measurements Lab	9
6	LAS 601	Industrial Management & Economics	11
	S 602	Industrial Electronics & Applications	12
	LTAS 603	Digital Signal Processing	13
	S 604	Process Instrumentation I	14
	S 605	Process Control	15
	S 606	Control system II	16
	S 607	Instrumentation Lab-I	17
	AS 608	Mini Project	18
7	S 701	Process Instrumentation II	20
	S 702	Analytical Instrumentation	21
	S 703	Data Acquisition &Communication	22
	S 704	Computer Control of Process	23
	AS 705	Biomedical Instrumentation	24
	S 706	Elective-I	25-29
	LAS 707	Microprocessor & Microcontroller Lab	30
	S 708	Instrumentation Lab II	31
	S 709	Project Design & Seminar	32
8	LAS 801	Computer Networks	34
	S 802	Analysis and Design of Instrumentation Systems	35
	LAS 803	Advanced Microprocessors	36
	S 804	Fibre Optics & Laser Instrumentation	37
	S 805	Elective-II	38-42
	S 806	Elective-III	43-47
	S 807	Process Control Lab	48
	AS 808	Project & Seminar	49
	AS 809	Viva voce	49

ELECTIVE LISTS

	Subject	Subject Code	Page Nos.
ELECTIVE I	Optimization Techniques	CMELRTAS 706-1	25
For VII Semester	Object Oriented Programming in C++	LAS 706-2	26
	Fuzzy Systems	AS 706-3	27
	Artificial Intelligence & Expert Systems	AS 706-4	28
	Power Plant Instrumentation	S 706-5	29
ELECTIVE II	Advanced Mathematics	CMELRTS 805-1	38
For VIII Semester	VHDL	LAS 805-2	39
	Neural Networks	AS 805-3	40
	VLSI Technology	S 805-4	41
	Intelligent Control System	S 805-5	42
ELECTIVE III	Instrumentation in Petro Chemical Industries	S 806-1	43
For VIII Semester	Logic & Distributed Control System	S 806-2	44
	Robotics & Automation	S 806-3	45
	Embedded Systems	LAS 806-4	46
	Digital Image Processing	LAS 806-5	47

SCHEME OF SYLLABUS FOR ELECTRONICS & INSTRUMENTATION BRANCH IN M G UNIVERSITY, KOTTAYAM FOR 2002 ADMISSION ONWARDS

SEMESTER 5

Course No.	Subject	Teaching Periods			Uty. Exam duration (hours)	Marks			
		Lect.	Tut.	Prac.		Sessional	Theory	Practical	Total
CMELPAS 501	Engineering Mathematics IV	3	1	0	3	50	100	-	150
S 502	Electronic Instrumentation	3	1	0	3	50	100	-	150
S 503	Transducer Engineering	3	1	0	3	50	100	-	150
S 504	Control System - I	2	1	0	3	50	100	-	150
LAS 505	Linear Integrated Circuits	3	1	0	3	50	100	-	150
LS 506	Micro processors & Micro controllers	3	1	0	3	50	100	-	150
S 507	Linear and Digital IC Lab	0	0	4	3	50	-	100	150
S 508	Transducers and Measurements Lab	0	0	4	3	50	-	100	150
	Total Teaching Hours	**17**	**6**	**8**		**400**	**600**	**200**	**1200**

SEMESTER 6

Course No.	Subject	Teaching Periods			Uty. Exam duration (hours)	Marks			
		Lect.	Tut.	Prac.		Sessional	Theory	Practical	Total
LAS 601	Industrial Management & Economics	3	2	0	3	50	100	-	150
S 602	Industrial Electronics & Applications	2	1	0	3	50	100	-	150
LTAS 603	Digital Signal Processing	3	1	0	3	50	100	-	150
S 604	Process Instrumentation I	3	1	0	3	50	100	-	150
S 605	Process Control	3	1	0	3	50	100	-	150
S 606	Control System II	3	1	0	3	50	100	-	150
S 607	Instrumentation Lab I	0	0	3	3	50	-	100	150
AS 608	Mini Project	0	0	3	3	50	-	100	150
	Total Teaching Hours	**17**	**7**	**6**		**400**	**600**	**200**	**1200**

SEMESTER 7

Course No.	Subject	Teaching Periods			Uty. Exam duration (hours)	Marks			
		Lect.	Tut.	Prac.		Sessional	Theory	Practical	Total
S 701	Process Instrumentation II	3	1	0	3	50	100	-	150
S 702	Analytical Instrumentation	3	1	0	3	50	100	-	150
S 703	Data Acquisition & Communication	2	1	0	3	50	100	-	150
S 704	Computer Control of Process	3	1	0	3	50	100	-	150
AS 705	Biomedical Instrumentation	3	1	0	3	50	100	-	150
S 706	Elective I	3	1	0	3	50	100	-	150
LAS 707	Microprocessor and Microcontroller Lab	0	0	3	3	50	-	100	150
S 708	Instrumentation Lab II	0	0	3	3	50	-	100	150
S 709	Project Design & Seminar	0	0	2					
	Total Teaching Hours	**17**	**6**	**8**		**400**	**600**	**200**	**1200**

SEMESTER 8

Course No.	Subject	Teaching Periods			Uty. Exam duration (hours)	Marks			
		Lect.	Tut.	Prac.		Sessional	Theory	Practical	Total
LAS 801	Computer Networks	3	1	0	3	50	100	-	150
S 802	Analysis & Design of Instrumentation System	3	1	0	3	50	100	-	150
LAS 803	Advanced Microprocessors	3	1	0	3	50	100	-	150
S 804	Fibre Optics & Laser Instrumentation	3	1	0	3	50	100	-	150
S 805	Elective II	3	1	0	3	50	100	-	150
S 806	Elective III	3	1	0	3	50	100	-	150
S 807	Process Control Lab	0	0	3	3	50	-	100	150
AS 808	Project & Seminar	0	0	3	3	100	-		100
AS 809	Viva - Voce	0	0	0	-			50	50
	Total Teaching Hours	**18**	**6**	**6**		**450**	**600**	**150**	**1200**

FIFTH SEMESTER

CMELPAS 501 ENGINEERING MATHEMATICS –IV 3-1-0

Module 1

Complex Integration: Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities- Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

Module 2

Numerical solution of algebraic and transcendental equations: Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

Module 3

Numerical solution of ordinary differential equation: Taylor's series method- Euler's method – Modified Eulers method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

Module 4

Z – Transforms: Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property- inverse transform – solution of 1^{st} & 2^{nd} order difference equations with constant coefficients using Z transforms.

Module 5

Linear programming: graphical solution – solution using simplex method (non – degenerate case only) – Big-M method, two phase method- Duality in L.P.P.- Balanced T.P. – Vogels approximation method – Modi method.

References

1. Advanced Engineering Mathematics – Ervin Kreyszig, Wiley Eastern limited.
2. Numerical methods in Engineering & Science – Dr. B.S.Grewal, Kanna Publishers.
3. Higher Engineering Mathematics - Dr. B.S.Grewal, Kanna Publishers.
4. Numerical methods in Science & Engineering - Dr. M.K.Venkitaraman, National Publishing Company.
5. Quantitative techniques Theory & Problems - P.C.Tulsian, Vishal Pandey, Pearson Education Asia.
6. Complex variables and applications - Churchill and Brown, McGraw-Hill.
7. Operations research - Panneer Selvam, PHI.
8. Engineering Mathematics Vol. III-S Arumugam, A.T.Isaac, A.Somasundaram, Scitech Publications
9. Advanced Mathematics for Engg. Students Vol. III- S.Narayanan, T.K.M.Pillay, G.Ramanaigh, S.Vishwananthan Printers & Publishers

S 502 ELECRONIC INSTRUMENTATION 3-1-0

Module 1

Generalised instrumentation system – Units and standards- Calibration methods- Standards of measurement- Classification of errors- Error analysis.
Static characteristics – Accuracy, precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effect etc. – Dynamic characteristics.

Module 2

Electronic analog meters: DC voltmeters- Loading- Transfer volt meter- Chopper type- DC amplifier voltmeter- Solid state voltmeter – Differential voltmeter – Peak responding voltmeter – True RMS voltmeter – Calibration of DC instrument.
Digital voltmeter: – Introduction – Ramp technique – Dual slope - Integrating type DVM – Successive approximations type DVM – Resolution and sensitivity of digital meters – General specifications of a DVM.

Module 3

Analog instruments – Output power meters – Field strength meter - Phase meter – Vector impedance meter – Q meter – LCR bridge – Rxmeters – Automatic bridges – Transistor tester – Analog pH meter.
Digital instruments:– Digital multimeters – Digital frequency meter – Digital Measurement of time – Universal counter – Electronic counter – Digital Tachometer – Digital pH meter – Digital phase meter – Digital capacitance meter – Automation in digital instrument – Microprocessor based instruments – Digital instruments with GPIB interface.

Module 4

Signal generators: – Fixed and variable AF oscillators – AF sine and square wave generator. Function generator – Square and pulse generator – Random noise generator – Sweep generator – TV sweep generator – Marker generator – Sweep marker generator. Wobbiscope Video pattern generator – Colour bar generator – Vectroscope – Beat frequency oscillator (BFO) – frequency selective wave analyser – Heterodyne wave analyser – Harmonic distortion analyser – Spectrum analyser – Digital fourier analyser.

Module 5

Measuring instruments :- Principle of operation of galvanometers, PMMC, Moving iron instrument - Resistance measurement using Wheatstone bridge, Kelvin double bridge, Ohm meters AC bridges: Maxwell bridge - Maxwell wien bridge - Hey’s bridge- Schering bridge- Anderson bridge- Campbell bridge.

References

1. Albert.D.Hellfrick, William Cooper: Modern Electronic Instrumentation & Measurments Techniques, Prentice Hall of India Ltd-2003
2. Oliver.B.H & Cag.J.M.: Electronic Measurements & Instrumentation, McGrawHill-1992
3. Sawhney A. K: A course in Electrical and Electronic Measurements and Instrumentation, Dhanapat Rai and Sons, New Delhi, 1995.
4. H.S.Kalsi: Electronic Instrumentation, Tata McGraw Hill, 1999
5. David Buchla, Wayne Melachlan: Applied Electronic Instrumentation& Measurements, Prentice Hall-1992
6. A.J.Bouwens: Digital Instrumentation, Tata McGrawHill
7. Rangan, C.S.Sharma: Instrumentation Devices & Systems, Tata McGrawHill

S 503 TRANSDUCER ENGINEERING 3-1-0

Module 1

Definition of transducers- classification of transducers - passive transducers: principle of operation- construction details- characteristics and applications of passive electrical transducers- resistance potentiometers- strain gauges – resistance thermometers- thermistors - hot wire anemometer- resistive pressure transducers - Induction potentiometer- variable reluctance transducers- LVDT- capacitive transducers- variable air gap type- variable area type – variable permittivity type- capacitor microhone.

Module 2

Active transducers : Construction – Operation and features of active electrical transducers – Thermo electric transducers- Piezo electric transducers – Magnetosritic transducers- Hall effect transducers – Electro mechanical transducers – Photo electric transducers.
IC sensor for temperature and pressure-Smart sensor – Intelligent sensors- Humidity sensor- Electro optic sensors.

Module 3

Digital transducers: Construction –Operation and features of digital transducers – Digital displacement transducer –Frequency domain transducers – Digital encoder- Magnetic encoder- Digital pots and tacho meters- Transducer oscillators – Rotational displacement transducer- Introduction to fibre optic transducers- Eddy current transducers – Photo resistor-Pyro electric radiation detectors.

Module 4

Cathode Ray Oscilloscope : – Basic Principle – CRT features – Block diagram of oscilloscope – simple CRO – High frequency CRT or Travelling wave type CRT – Dual beam CRO – Dual trace oscilloscope – Special types of CRO – Sampling oscilloscope – Storage oscilloscope – Digital readout oscilloscope – Digital storage Oscilloscope (DSO) – Fiberoptic CRT recording oscilloscope – Typical measurements using CRO – Standard specifications of a single beam CRO – Probes for CRO – Applications of oscilloscope.

Module 5

Display devices- Classification of displays- LED's in direct and indirect band gap materials- Typical uses of LED's- Liquid Crystal Displays- Theory of LCD operation-Typical uses of LCD's. Recorders:- Strip chart recorders - Galvanometric recorders- Null type recorder-Circular chart recorder-X-Y recorder-UV recorder- Magnetic recorder-Direct recording- FM recording-Digital data recorders- Digital memory waveform recorder(DWR)- Electro mechanical recorders.

REFERENCES

1. Doebelin, E.O., Measurement Systems, McGraw Hill Book Co., 1998.
2. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997
3. Albert.D.Hellfrick, William Cooper: Modern Electronic Instrumentation & Measurments Techniques, Prentice Hall of India Ltd-1992
4. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Renganathan, S., Transducer Engineering, Allied Publishers, Chennai, 1999.
6. Alan S Morris: Principles of Measurement and Instrumentation, PHI 1993.
7. B.S. Sonde, Transducers and display systems, Tata McGraw Hill, New Delhi 1979.

S 504 **CONTROL SYSTEMS –I** **2-1-O**

Module 1

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

Time domain Analysis – Type and order of a system – typical test signals for the time response of control system –Unit step, unit ramp and unit impulse - response of first and second order systems – steady state error – static and dynamic error coefficients – concepts of stability – Routh Hurwitz criterion – basic ideas of proportional, derivative and integral controllers-study of electronic PID controllers.

Module 3

Frequency domain analysis – frequency response – frequency domain specifications – Bode Plot – Nicol's chart – Nyquist stability criterion – relative stability – gain margin – phase margin-study of DC motor as a controlled system.

Module 4

Root Locus technique – basic theory and properties of root loci – procedure for construction of root loci – error detectors – compensation techniques- lag compensator – lead compensator – lag lead compensator (design of compensators is not needed).

Module 5

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 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.

LAS 505 LINEAR INTEGRATED CIRCUITS 3 -1 - 0

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

Op amp applications- Summer- Subtractor- Log amplifier- Antilog amplifier- Comparators: zero crossing- using voltage reference- regenerative (Schmitt trigger) comparators- Astable and monostable multivibrators- Triangular and sawtooth wave generators- Integrator and differentiator- RC phase shift and Wien bridge oscillators-Sample and hold circuit- Peak detector circuit.

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

Specialized ICs and applications: Voltage regulator ICs – 78XX and 79XX series- 317 variable regulators- 1723 switching regulators- 566 VCO chip- Phase locked loop(PLL) - capture and lock range- 565 PLL - PLL applications: Frequency multiplication and division- AM demodulation- FM detection- FSK demodulation - LM 380 power amplifier - intercom using LM 380- 8038 Function generator chip - applications.

References

1. Op amps and Linear Integrated circuits: Ramakand Gaykwad- PHI publications.
2. Op amps and Linear Integrated circuits: R F Coughlin- Pearson Education.
3. Op amps and Linear Integrated circuits: Ravi Raj Dudeja- Umesh Publications.
4. Linear Integrated circuits: Roy Choudhary & Jain- Wiely Eastern Publications.
5. Integrated circuits: K R Botkar

LS 506 MICROPROCESSORS AND MICROCONTROLLERS 3 – 1- 0

Module1

Introduction to microprocessors and microcomputers: Function of microprocessors- architecture of 8085- pin configuration and functions – tristate bus concept - generation of control signals - bus timings – de-multiplexing AD_0-AD_7 – flags - memory decoding - interfacing of RAM and EPROM - I/O addressing - I/O mapped I/O - and memory mapped I/O schemes - instruction execution - fetch/execute cycle - instruction timings and operation status.

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

Machine cycles – interrupts - interrupt sources - interrupt enable register - interrupt priority - interrupt control system - interrupt handling - single step operation - port bit latches and buffers - port structures and operation - accessing external memory – programming examples.

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

1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
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

S 507 LINEAR AND DIGITAL IC LAB 0 – 0 – 4

1. Op-Amp configurations-Inverter, Non inverter
2. Op- Amp applications-Summer, Subtracter, Integrator, Differentiator.
3. Design and testing of instrumentation amplifier
4. Design and testing of precision rectifier
5. Design and testing of active filters
6. Design and testing of waveform generators using op-amps----square, triangular
7. Design and testing of multivibrators using 555
8. Simplification of a logic function and its realization using (1) AND, OR, NOT gates and (11) Universal gates
9. Design and analysis of Adder & Subtracter
10. Design of code converters a) Binary to Gray b) Binary to excess c) BCD to Decimal
11. Verification of truth tables of JK, RS, D, and T flip flops
12. Design of Synchronous counters and sequence generators.
13. Shift registers
14. Multiplexer and Demultiplexer

S 508 TRANSDUCERS AND MEASUREMENTS LAB 0 – 0- 4

1. LDR and Optocoupler Characteristics.
2. RTD and Thermistor Characteristics.
3. Strain Gauge and Load cell Characteristics
4. LVDT and Tacho generator Characteristics.
5. Thermocouple Characteristics and Cold Junction Compensation.
6. Vibration Measurement and Analysis.
7. Capacitor Transducers and IC Temperature Sensor (AD 590).
8. Measurement of pH.
9. Measurement of L, C, R using bridges.
10. Measurement of Wind Speed Using Anemometer.
11. Measurement of Speed-contact and Non-contact Types.
12. Measurement of Viscosity Using Redwood Viscometer.
13. Measurement of Water Conductivity.
14. Measurement of Earth Resistance.

SIXTH SEMESTER

LAS 601 INDUSTRIAL MANAGEMENT & ECONOMICS 3 – 2 - 0

PART A: INDUSTRIAL MANAGEMENT

Module 1

Modern concept of Management: Scientific management-Functions of management-Planning-Organising- Staffing-Directing- Motivating- Communicating- Co-ordinating- Controlling-Organisational structures- Line, Line and staff and Functional relationships- Span of control-Delegation- Management by Objectives.

Module 2

Personnel management: Objectives and functions of personnel management- Recruitment-Selection and training of workers- Labour Welfare- Industrial Fatigue- Industrial disputes-Trade Unions-Quality circles. Formation of companies: Proprietory-Partnership-Joint stock companies- Public sector- Joint sector and Co-operative sector.

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

Theory of demand and supply- Price mechanism- Factors of production- Land, labour, capital and organization- National income- Difficulties in estimation- Taxation- Direct and indirect taxes-Progressive and regressive- Black money- Inflation-Causes and consequences.

Module 5

Indian financial system- Reserve bank of India: Functions- Commercial banking system-Development financial institutions- IDBI- ICICI- SIDBI- IRBI- NABARD- Investment institutions-UTI- Insurance companies- Indian capital market- Stock market- Functions- Role of the public sector- Privatisation- Multinational corporations and their impact on the Indian economy.

References

1. Industrial Management - O P Khanna, Dhanpat Rai Pub.
2. Industrial Management - K.K. Ahuja, Khanna Pub.
3. Marketing Management - Philip Kotler, PHI
4. Indian economy - A.N. Agarwal, Wishwa Prakashan
5. Modern economic theory - K.K Dewett, Shyam Lal charitable trust.

S 602 INDUSTRIAL ELECTRONICS AND APPLICATIONS 2- 1- 0

Module 1

Power diodes – power transistor – power MOSFET - characteristics of SCR, Triac–IGBT – MCT – LASCR – SCR turn on, turn off characteristics – thyristor specifications – thyristor protection circuits – series and parallel operations of SCR- Thyristor trigger circuits – R ,RL,RC triggering.

Module 2

AC to DC converters – single phase – three phase – half controlled and fully controlled rectifiers – free wheeling effect - effect of source and load inductance – dual converters – cyclo converters.

Module 3

Inverters and voltage source inverters – series, parallel and bridge inverters – current source inverters – PWM inverters – D.C. chopper – step up and step down chopper – AC chopper: AC converters: – uninterrupted power supply (UPS) – (circuit diagram approach), rectifier — inverter – static transfer switch.

DC to DC converters: choppers: SMPS, battery charger circuits

Module 4

D.C Motor control: phase control, Single phase SCR drive – Three phase SCR drive – speed control of dc series motor – Chopper controlled dc drives – PLL control of dc motor, A.C. Motor control : controlled – slip system – slip power recovery system - stepper motor drive - synchronous motor control.

Module 5

Control circuits for power electronics: basic schemes for pulse generation using analog and digital ICs. Single, double and four quadrant systems. Series and parallel operations of thyristors, cable firing, isolation etc.

TEXT BOOKS

1. P.S.Bimbhra, 'Power Electronics', Khanna Publishers, New Delhi, 2002
2 G.K.Dubey, Doradia, S.R. Joshi and R.M.Sinha, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 1996.

REFERENCES

1. M.H.Rashid, Power Electronics – circuits, devices and applications, PHI, New Delhi, 1995.
2. Joseph Vithyathi, Power Electronics, McGraw Hill, USA, 1995.
3. Mohan, Undeland and Robbins, Power Electronics, John Wiley and Sons, New York, 1995.
4. P.C.Sen, Modern Power Electronics, Wheeler publishers, New Delhi, 1998
5. M.D.Singh, K.B. Khanchandani: Power Electronics, TMH, 1998

LTAS 603 DIGITAL SIGNAL PROCESSING 3 – 1- 0

Module1

Review of signals and systems: Introduction - advantages and limitations of Digital Signal Processing. Infinite Impulse Response (IIR) Filters - Signal Flow graph- Basic Network structure for IIR filter- Direct- Cascade- Parallel Forms. Design of IIR Digital filters from analog filters- Butterworth design- Chebyshev design- design based on numerical solutions of differential equations- Impulse Invariant Transformation.

Module 2

Finite Impulse Response (FIR) Filters**:** Linear phase FIR filters- Frequency response of linear phase FIR filters - Location of the zeros of linear phase FIR filters. Realization of FIR- cascade - lattice design-Fourier Series method- using windows-rectangular- triangular or Barlett windows- Hanning- Hamming- Blackman- Kaiser windows.

Module 3

Discrete Transforms: fourier**,** Properties-Circular convolution- Linear Convolution using DFT- relation between Z- Transform and DFT- difference equations, 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

Applications of digital signal processing: Speech Processing- speech analysis- speech coding- sub band coding- channel recorder- homomorphic recorder- digital processing of audio signals- Radar signal processing- DSP based measurements systems. Equi ripple FIR design- PCM DSP chips- a general study.

References

1. Digital signal processing: Ifechor- Pearson edn.
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.
6. Digital signal processing: P Ramesh Babu- Scitech Pub.

S 604 PROCESS INSTRUMENTATION –I 3 -1- 0

Module 1

Measurement of force, torque, velocity :- Electric balance – Different types of load cells – Magnets – Elastics load cell-Strain gauge load cell-Different methods of torque measurement, Strain gauge, Relative regular twist-Speed measurement-Revelution counter- Capacitive tacho-Drag up type tacho-D.C and A.C tacho generators – Stroboscope.

Module 2

Measurement of acceleration, vibration and density :- Accelerometers – LVDT, Piezo-electric, Strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick ups – Units of density, specific gravity and viscosity used in industries – Baume scale API scale – pressure head type densitometer – float type densitometer – Ultrasonic densitometer - Bridge type gas densitometer.

Module 3

Pressure measurement : - Units of pressure – Manometers – Different types – Eelastic type pressure gauges – Bourde type- Bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge –Piezo resistive pressure sensor –Resonator pressure sensor – Measurement of vacuum – McLeod gauge –Tthermal conductivity gauges – Ionization gauge - Cold cathode and hot cathode types –Testing and calibration of pressure gauges – Dead weight tester- Bulk gauge(high pressure measurement).

Module 4

Temperature measurement :- Definitions and standards – Primary and secondary fixed points – Calibration of thermometers - Different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics –3 lead and 4 lead RTDs - Thermistors –Linearization techniques.

Module 5

Thermocouples – Law of thermocouple – Fabrication of industrial thermocouples– Signal conditioning of thermocouple output – Thermal block references functions – Commercial circuits for cold junction compensation – Response of thermocouple – Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement –Rradiation fundamentals – Total radiation and selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometer.

TEXT BOOKS

1. Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw Hill Book Company, 1998.
2. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

REFERENCES

1. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation–Dhanpat Rai and Sons, New Delhi, 1999.
3. P.Holman, Experimental Methods for Engineers International Student Edition, McGraw Hill Book Company, 1971.
4. B.C.Nakra and K.K.Chaudary, Instrumentation Measurement and Analysis, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.

S 605 **PROCESS CONTROL** **3 – 1- 0**

Module 1

Need for process control-Process variables-Degree of freedom-Characteristics of liquid systems, gas systems, thermal systems- Mathematical model of first order level, pressure& thermal process-Higher order process-Interacting and non interacting systems-Continuous and batch process-Self regulation-Servo and regulator operation.

Module 2

Basic control actions- Characteristics of ON-OFF, Proportional, Single speed floating , Integral & Derivative control modes-Composite control modes- P+I,P+D ,P+I+D control modes-Response of controllers for different types of test inputs- Pneumatic and Electronic controllers to realize various control actions-Selection of control mode for different processes.

Module 3

Optimum controller settings- Ttuning of controllers by process reaction curve method-Continuous cycling method-Damped oscillation method-Ziegler Nichols methods-1/4 decay ratio-Feed forward control-Ratio control-Cascade control-Averaging control-Multivariable control.

Module 4

I/P & P/I converters -Pneumatic & Electric actuators- Valve positioner-Control valves-Characteristics of control valves- Inherent and installed characteristics-Valve body-Globe, Butterfly, Diaphragm-Ball valves-Ccontrol valves sizing- Cavitation and flashing-Selection criterion.

Module 5

Distillation column- Control of top and bottom product compositions- Reflux ratio-Control of chemical reactors – Control of heat exchanger- Steam boiler- Drum level control and combustion control- Piping and instrumentation diagram of control loops.

TEXT BOOKS

1. Stephanopoulis, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990.
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993.

REFERENCES

1. Pollard A. Process Control, Heinemann educational books, London, 1971.
2. Harriott. P., Process Control, Tata McGraw Hill Publishing Co., New Delhi, 1991.

S 606 **CONTROL SYSTEMS II** **3 – 1- 0**

Module 1

Limitation of Conventional Control Theory - Concepts of state variable and state model - state model for linear time invariant systems.
State space representation of dynamic systems: physical notion of system state, block diagram representations. Lagrang's equations – examples

Module 2

Transformation of state variables, solution of differential equations in state space form, interpretation and properties of the state transition matrix, solution by the laplace transform, the resolvent, transfer function from state model, state space representations of transfer functions.
Decomposition of Transfer functions: Direct, cascade and parallel decomposition technique.

Module 3

State space modelling of systems: Inverted pendulum on a cart, Temperature control - two capacitance system, spring coupled masses, distillation column, instrument servo, missile guidance dynamics. Controllability and Observability: Physical interpretation, Kalman's and Gilbert's tests, Effect of pole - zero cancellation, detectability and stabilisability.

Module 4

Shaping the dynamic response - Design of regulators for single input single output systems, Bass-gura pole placement formula, Multiple input systems, disturbances and tracking systems: exogenous variables.
Linear observers: Need of observers, structure and properties of observers, pole placement for single output systems.

Module 5

Introduction to MATLAB - MATLAB functions - m - files- analysis and design of control systems using MATLAB, Simulink - construction and analysis of simple models - modelling of systems given in module II

References

1. B.Friedland - Control System Design - An Introduction to state space methods - Mc Graw Hill, Inc. N Y
2. T. Kailath - Linear systems - Prentice Hall Inc., Englewood cliffs. N J
3. C.Chen - Analog and Digital Control System Design - Transfer function, State Space and algebraic methods, Saunders College Publishing, N.Y
4. A Nagooe Kani – Advanced Control Theory

S 607 INSTRUMENTATION LAB I 0- 0- 3

1. Construction and testing of a digital frequency /phase meter.
2. Construction and testing of a digital volt meter gating circuit.
3. Construction and testing of a true RMS volt meter
4. Construction and testing of a FET input volt meter
5. Construction and testing of a multi range rectifier type volt meter and ammeter
6. Design and testing of a temperature control
7. Calibration of voltmeter and ammeter using precision potentiometer
8. Calibration of wattmeter
9. Calibration of energy meter
10. Calibration of pressure gauge using dead weight tester
11. Usage of Spectrum analyser/distortion analyser
12. Usage of Digital storage oscilloscope
13. Electro magnetic flow meter
14. Study of DSP trainer.

MINI PROJECT

AS 608 **0 – 0 - 3**

Each student should conceive, design, develop and realize an electronic product. The basic elements of product design - the function ergonomics and aesthetics - should be considered while conceiving and designing the product. The electronic part of the product should be an application of the analog & digital system covered up to the 6^{th} semester. The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination.

SEVENTH SEMESTER

S701 PROCESS INSTRUMENTATION – II 3 – 1- 0

Module 1

Measurement of viscosity, humidity and moisture : - Viscosity terms – Say bolt viscometer – Rotameter type viscometer – Industrial consistency meters – Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter – Moisture terms – Different methods of moisture measurement – Moisture measurement in granular materials, solid penetrable materials like wood, web type material.

Module 2

Mechanical type flowmeters : - Types of flow – Continuity equation – Bernoulli's theorem – limitations – Reynold's number – Square root compensation.(basic concepts only). Theory of fixed restriction variable head type flow meters – Orifice plate – Venturi tube – Flow nozzle – Dall tube – Installation of head flow meters – Piping arrangement for different fluids – Pitot tube.

Module 3

Quantity meters, area flow meters and mass flow meters : - Positive displacement flow meters – Constructional details and theory of operation of mutating disc, Reciprocation piston, Oval gear and helix type flow meters – Inferential meter – Turbine flow meter – Rota meter – Theory and installation – Angular momentum mass flow meter – Carioles mass flow meters – Thermal mass flow meter – Volume flow meter plus density measurement – Calibration of flow meters – Dynamic weighing method.

Module 4

Electrical type flow meter : - Principle and constructional details of electromagnetic flow meter Ddifferent types of excitation –Schemes used – Different types of ultrasonic flow meters – Laser Doppler anemometer systems – Vortex shedding flow meter – Target flow meter – Solid flow rate measurement – Guidelines for selection of flow meter.

Module 5

Level measurement :- Gauge glass technique coupled with photo electric readout system – Float type level indication – Different schemes – Level switches - Level measurement using displacer and torque tube – Bubbler system. Boiler drum level measurement – Differential pressure method –Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors – Level measurement of corrosive fluids.

TEXT BOOKS

1. D. Patranabis, Principles of Industrial Instrumentation Tata McGraw Hill Publishing Co., New Delhi, 1999
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi 1999.

REFERENCES

1. Ernest O. Doebelin, Measurement systems application and design international student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation – Dhanpat Rai and Sons, New Delhi, 1999.
3. Eckman D.P.Industrial Instrumentation – Wiley Eastern Limited, 1990.
4. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.

S 702 ANALYTICAL INSTRUMENTATION 3 – 1 -0

Module 1

ph conductivity & gas analysers : - Sampling systems – Ion selective electrodes – Conductivity meters – pH meters – Dissolved oxygen meter–Water purity meter-Steam purity meter- Sodium analyser –Flue gas analyser-CO analyser- Oxygen analyser using paramagnetic, Depolarisation principle—Dust and smoke measurement.

Module 2

Chromatography : - Gas chromatography – Methods of analysis in gas chromatography-Column details Detectors- Thermal conductivity detectors- Flame ionization detectors-Flame photometric detectors Electron capture detectors-Effect of temperature.

Liquid chromatography – Pre column- Separation column—Detectors- High pressure liquid chromatography.

Module 3

Spectro photometers : - Electro magnetic radiation-Electro magnetic spectrum- Spectral methods of analysis – Absorption spectroscopy - Beer's Law - UV – Visible spectrophotometers – Single beam and double beam instruments – Sources and detectors – IR spectrophotometers – Sources and detectors – FTIR spectrometers-Raman spectrograph.

Module 4

Flame &microwave spectrography :- Flame emission spectrometry –Atomic absorption spectrometry Atomic fluorescence spectrometry –Types of commercial flame photometers-applications.

Microwave spectrograph – ESR and EPR spectroscopy basic principles- Instrumentation techniques and applications.

Module 5

Nuclear Magnetic Resonance and radiation techniques : - NMR – basic principle – NMR spectrometers –Applications – Nuclear radiation detectors – GM counter – Proportional counter – Ionization chamber – Scintillation counter – Semiconductor detectors — Introduction to x- ray spectroscopy - Production of X-rays and X-ray spectra-Direct X-ray methods-X-ray absorption methods-X-ray fluorescence spectrometer – X-ray diffraction.

TEXT BOOKS

1. Willard, H.H., Merrit L.L., Dean J.A Seattle F.L., 'Instrumental Methods of Analysis', CBS Publishing and Distribution, 1995
2. Robert D. Braun, Introduction to Instrumental Analysis, McGraw – Hill, Singapore, 1987
3. Jain R. K. Fundamentals of mechanical and industrial instruments, Khanna Publishers, 1986

REFERENCES

1. Skoog, D.A. and West D.M., Principles of Instrumental Analysis, Holt Sounder Publication, Philadelphia, 1985
2. Ewing G.W., Instrumental Methods of Analysis', McGraw Hill, 1992
3. Mann C.K. Vickers, T.J. and Guillick W.H Instrumental Analysis, Harper and Row Publishers, New York, 1974.
4. Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995
5. Frank A. Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, New Jersey, 1997

S 703 DATA ACQUISITION &COMMUNICATION 2+1+0

Module 1

Communication concepts – Analog modulation – Various schemes – AM, PM, FM –Sampling theorem - Analog pulse modulation – PAM, PWM, PPM – Generation of various modulated waves (Block diagram only) –Digital Pulse modulation (PCM).

Module 2

Multiplexing - Frequency Division Multiplexing (FDM) – Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing –Statistical time Division multiplexing – Key Techniques - ASK, FSK, PSK, DPSK - Channel capacity - Shannon`s Theorem.

Module 3

Digital data transmission – Serial, Parallel, Synchronous, Asynchronous and Isochronous transmission. Transmission mode- Simplex - Half duplex – Full duplex, Noise- different types of noise – Basic Principles of Switching (circuit, packet, message switching)

Module 4

Data acquisition systems – sampling theorem – sampling and digitizing aliasing– sample and hold circuits – practical implementation of sampling and digitizing – review of programmable peripherals – definition – design of and need for data acquisition systems – interfacing AID and DIA with microprocessors – or PIC – multiplexed channel operation – ground returns – microprocessor /pc based data acquisition systems.

Module 5

Terminal handling – Point to point, Multidrop lines. Components of computer communication – Concentrators - Front end Processor – Transmission media – Guided media – Twisted pair cable, coaxial cable, fibre optic cable. GSM service and GSM system architecture.

References

1. Electronic communication system - Kennedy, Mc Graw Hill.
2. Principles of Communication System- Taub & Schilling Mc Graw Hill.
3. Introduction to Data Communications & Networking - Behurouz & Forozan Mc Graw Hill.
4. Data Communication, Computer Networks & Open Systems - Fred Halsall Pearson Education Asia
5. Principles & Application of GSM. - Vijay K. Garg Pearson Education Asia
6. Modern Digital & Analog Communication Systems – B.P Lathi Prism Books Pvt. Ltd.
7. Computer Networks - A.S. Tanenbaum, PHI
8. Data and Computer Communication - William Stallings, Pearson Education Asia
9. Communication Engineering - A. Kumar, Umesh Publications

S 704 COMPUTER CONTROL OF PROCESS 3 – 1- 0

Module1

Introduction to computer control of process-Need for computers in a control systems-Functional block diagram of a computer control system-Direct digital control –Multi channel data acquisition system (DAS) - SCADA- Online hierarchical control – Digital control interfacing – process input – Output interface along with processing – Data logger.
Virtual instrumentation: Definition – Parts of the system – Windows in data acquisition – Personal computers for data acquisition system and instrument control – Instrument drivers.

Module 2

Control algorithms : Design of control algorithms using Z transforms – Dead beat algorithm – Dahlin's method –Ringing – Kalman's approach – Digital equivalent to a conventional controller – PID algorithm – Position and velocity form stunning techniques – Self tuning and adaptive algorithms – Stability of sampled data control system- Schurr – Cohn stability criterion – Modified Z transforms to system with dead time –Smith predictor algorithms.

Module 3

System modelling and identification – Mathematical model for process – First order, second order process without and with pure delay – Higher order systems – Process modelling from step test data – Pulse testing for process identification – Linear least square algorithm.

Module 4

Programmable logic controllers:– combinational logic controllers – sequential logic controllers – logic controller design using programmable logic devices- PLC – configuration – ladder diagram – PLC programming languages – commercially available PLC 's – relay based PLC – microprocessor based PLC – Interlocks– Connecting PLC to computer – Use of PC and PLC – Case study of bottle filling system

Module 5

Distributed control systems (DCS- Significants of DCS-configuration-data highways, field buses, multiplexers and remote terminal units-types of displays-CRT displays-flow sheet symbols, I/O hardware and set point stations.

TEXT BOOKS

1. Deshpande, P.B. and Ash R.H., Elements of Computer Process Control, Instruments Society of America, 1981
2. C.L.Smith, Digital Computer Process Control, Intext Educational Publications 1972
3. Petrezeulla, Programmable Controllers, McGraw Hill, 1989
4. Houpis C.M., Lamount, G.B., Digital Control Systems – Theory, Hardware and Software International student Edition, McGraw Hill Book Co., 1985
5 Stephanoupoulis, G., Chemical Process Control, Prentice Hall of India, New Delhi, 1990
6 Hughes T, Programmable Logic Controllers, ISA Press, 1989.
7. M.P.Lukas, Distributed Control System, Van Nostrand Rainhold Compony 1986.
8. B.G.Liptak, Handbook of Process Control 1996

AS 705 BIOMEDICAL INSTRUMENTATION 3 -1- 0

Module 1

Human anatomy & physiology: Anatomy & physiology of major systems of the body. Principles of generation and propagation of bioelectric potentials. Electrical activity of heart, propagation of action through nerves, conduction velocity and latency. EMG, EMC, ECG, ERG, EEG, MEG. Electrical safety – physiological effects of electricity, Micro & macro shock hazards. Electrical safety codes & standards .Protection of patients, power distribution and equipment design.

Module 2

Electrodes & transducers: Bio potential electrodes – different types of electrodes, polarisable, & non polarisable electrodes. Theory of electrode – skin interface. Electrode behaviour & circuit models. Electrodes for stimulation. Transducers Leads, & Electrodes: transducers for biological applications – transduction, Principles, different types – active and passive transducers implantable transducers, transducers for pressure, flow, pulse, respiration. Chemical sensors Leads & Electrodes: Types, Materials, properties, characteristics. Method of application and selection – equivalent circuits of leads & electrodes

Module 3

Bio potential amplifiers, recorders & monitors: Amplifiers : for ECG,EMG & EEG – basic requirements, design considerations –frequency ,gain etc. ECG: Working Principles, electrode systems and clinical applications, EEG: Working principles lead systems and clinical applications EMG: Working principles and clinical applications. Evoked potential systems, determination of conduction velocity and latency. Phono cardiography – principle and clinical applications, Bio potential recording– Noise, motion artifact and other considerations Recorders: Potentiometer, galvanometer, electrostatic UV recorder and magnetic tape recorder

Module 4

Diagnosis and therapeutic equipments:- Diagnosis Equipments- Electronic BP monitors, pulse monitors, electrocardioscope, spirometer, pulse oxi meter, ECG machine, EEG machine, EMG machine, EOG machine, ERG machine, PH meter, auto analyzer, gas analyser.

Module 5

Therapeutic Equipments– Pacemakers, Defibrillator, heart – lung machine, nerve and muscle stimulators, dialysis machines Surgical diathermy equipment, micro wave – short wave and ultrasound diathermy equipments, Nebuliser, Inhalator, Aspirator Humidifier and ventilators.
Electrical Safety – Physiological effects of electricity, Micro and macro shock hazards.Electrical safety codes & standards. Protection of patients, Power distribution and equipment design.

Text Books

1. Leslie Cromwell, Fred J. Weibell and Erich A Pferffer – Biomedical Instrumentation and measurements - Prentice Hall of India,1990.
2. R.S Khandpur – Handbook of Biomedical Instrumentation – Tata McGraw Hill

References

1. John G Webster – Medical Instrumentation – Application and Design – Houghton Mifflin Company, Boston
2 John G Cobbold – Transducers for Biomedical Instrumentation – John Wiley & Sons
3. Jacob Kline – Handbook of Biomedical Engineering – Academic Press INC.

OPTIMIZATION TECHNIQUES (ELECTIVE - I)

CMELRTAS 706-1 **3 – 1 - 0**

Module1 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 spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

References

1. Optimization theory and application: S.S. Rao, New Age International P. Ltd.
2. Optimization Concepts and applications in Engineering: A. D. Belegundu, T.R. Chandrupatla, Pearson Education Asia.
3. Principles of Operations Research for Management: - F.S.Budnick, D. McLeavey, R. Mojena, Richard D. Irwin, INC
4. Operation Research an introduction: H. A. Taha, Eastern Economy Edition.
5. Operations Research: R. Panneerselvam, PHI

OBJECT ORIENTED PROGRAMMING IN C++ (ELECTIVE - I)

LAS 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

1. Data abstraction & OOP in C++: Gordenkeeth, Wiley Eastern.
2. Object oriented programming with C++: E. Balaguruswamy, TMH.
3. C++: Strostrout.
4. Object Oriented Programming in C++: Nabajyoti Bjarne.

FUZZY SYSTEMS (ELECTIVE - I)

AS 706-3 **3+2+0**

Module 1

Introduction to Fuzzy sets and systems. Basics of fuzzy sets membership function, support of a fuzzy set, height - normalised fuzzy set, α - cuts (decomposition of a fuzzy set), set theoretic definitions on fuzzy sets, complement, intersection and union equality, subsethood - basic definition based on membership functions.

Module 2

The law of the excluded middle and law of contradiction on fuzzy sets. Properties of fuzzy sets operations (logical proof only). Extension of fuzzy sets concepts - type-2 and level 2 fuzzy sets - examples.

Module 3

Operations on fuzzy sets - intersection, algebraic sum - product, bounded sum - product, drastic sum product, t-norms and t-conorms (s - norms) on fuzzy sets, typical parameterised t - norms and s-norms (with simplified proof). Extension principle and its applications.

Module 4

Fuzzy relation. Resolution form of a binary fuzzy relation. Operations on fuzzy relations - projection, max-min. and min and max, compositions cylindric extension. Similarity relations - reflexivity, symmetry, transitivity.

Module 5

Further operations on fuzzy sets and proposed by Zadeh - concentration dilation, contrast Intensification, a linguistic hedges, computation of the meaning of values of a linguistic variable, fuzzy algorithms, fuzzy engineering - applications of fuzzy controls, case studies.

References

1. C.T lin & C S George Lee. Neural Fuzzy Systems, Prentice Hall.
2. Earl Cox. Fuzzy Systems Handbook, Associated Press
3. Klir and Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India.
4. IEEE Trans on Systems, Man & Cybernetics, vol. SMC - 3, No.1, January 1973, pp 28-44
5. Bart Kosko. Fuzzy Engineering, Prentice Hall.
6. Bart Kosko. Fuzzy Thinking, Hooper Collins Publications.

ARTIFICAL INTELLIGENCE & EXPERT SYSTEMS (ELECTIVE - I)

AS 706-4 **3+1+0**

Module 1 Introduction

Definitions- AI applications- Data, information and knowledge problems and problem space, problem characteristics, forward and backward reasoning means – ends – analysis – puzzle problems, Tower of Hanoi problem, game playing.

Module 2 Search

Search strategies, AND OR graphs, Heuristic search methods A and AO* algorithms, MIN – MAX strategies, Alpha – Beta cut offs.

Module 3 Knowledge representation

Propositional logic predicate logic, conversion of WFF to clause form, resolution, Unification, resolution – refutation system, question answering – non monotinic reasoning, fuzzy logics.

Module 4 Knowledge Structure

Semantic nets, frames, scripts, conceptual dependency – learning knowledge acquisition, different methods of learning.

Module 5 Knowledge engineering and Expert Systems

Structure of an expert system, distinctive features – case studies.

Text Books

1. Rich E., Artificial Intelligence, MGH

References

1. Nison N.J., Problem solving methods in Artificial Intelligence, MGH
2. Winston P.H., Artificial Intelligence, Academic Press, 1977

S 706 - 5 POWER PLANT INSTRUMENTATION (ELECTIVE -I) 3 – 1 -0

Module 1

Importance of measurement and instrumentation in Power Plant- Brief survey of methods of Power Generation- Hydro-thermal-nuclear-solar and wind power- Piping and instrumentation diagram of a Thermal Power Plant – Description of the processes – Water stream of cycle fuels- Steam generators – Electric Power Generation. Combustion of Fuels (Gaseous, Liquid and Solid)- Excess Air – Combustion Chemistry and products of Combustion- Requirements of Excess Combustion air – Calculation of efficiency of boilers –Input /out put method – Heat loss method .

Module 2

Water level gauges for boiler drums – Closed circuit television instruments – Hot well and dearator levels – Super heaters and desuper heaters- Super heated steam temperature – Feed water and gas temperature measurement – Steam pressure – Feed water pressure – Dearature pressure measurement –Turbine monitoring, speed, vibration, shell temperature measurement- Measurement of impurities in feed water and steam.

Module 3

Combustion control systems- Combustion control for liquid and gaseous fuel boilers-Combustion control for stokers- Combustion control for pulverized coal fired boilers- Drum level control systems (two element & three element control)

Module 4

Feed water supply and boiler water circulation control systems-Measurement and control of furnace draft- Hydrogen generators - Cooling systems- Protective devices- Electromagnetic attractive type relay- Over current relay- Differential relay- Current balance relay- Electrostatic precipitator- Smock density measurement.

Module 5

Piping and instrumentation diagram of nuclear power plant- Types of reactors in nuclear power plant- Radiation detection instruments- Process sensors for nuclear power plants- Nuclear reactors control systems and allied instrumentation. Load despatch computer- Dedicated micro computers for sequencing data logging and alarming.

TEXT BOOKS

1. Bela G.Liptak: Instrumention in the process industries, volume 1 & 2, Chilton Book CO, 1973
2. D.M.Considine: Hand book of applied instrumentation, McGraw Hill,1964
3. Sam.G.Dukelow: The control of boilers, Instruments Society of America Press
4. A.Sherry et.al (Editors): Modern power station practice, Volume 6, Pergamon Press 1971

MICROPROCESSOR AND MICROCONTROLLER LAB

LAS 707 **0+0+3**

1. Familiarization of 8085 trainer kit, manual code entry, simple examples.
2. Design and construction of a simple flash programmer for 89C51/89C2051 µC.
3. Study of Intel Hex file format.
4. Computer aided assembly language program development for 89C51/89C2051.
5. Use of assembler, linker and simulator for 89C51/89C2051.
6. Programming examples. Sorting, arithmetic operations (Using assembler, simulator).
7. Programming examples using Embedded ‘C’ compiler for 89C51/89C2051.
8. Programming examples using timer, external interrupts.
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.

S 708 INSTRUMENTATION LAB-II 0 -0 -3

1. Electro Cardio Graph
2. Electro Myograph
3. Electro Encephalograph
4. Nerve and Muscle Simulator
5. Design and Testing of Bio-signal Conditioning Circuit
6. Study of Recorders
7. Flame Photometer
8. Spectro Photometer
9. Liquid Analyser
10. Gas Analyser
11. Dissolved Oxygen Analyser
12. Gas chromatograph
13. psychrometer
14. Hygrometer
15. Colorimeter.

PROJECT DESIGN & SEMINAR

S 709 **0+0+2**

PROJECT DESIGN

The student is expected to complete the design of the project work and submit the design phase report.

SEMINAR

The student is expected to present a seminar in one of the current topics in Electronics, Instrumentation, Computers, Information Technology, Control Systems, Biomedical and related areas. The student will undertake a detailed study on the chosen subject and submit a seminar report at the end of the semester.

EIGHTH SEMESTER

COMPUTER NETWORKS

LAS 801 **3 – 1 - 0**

Module 1

Network goals -topologies- configurations-concept of internet- ISO-OSI 7 Layer Standard -peer processes-Functions of each layer-TCP/IP reference model - Transmission media -description and characteristics - base band and broad band transmission-synchronous and asynchronous -full duplex, half duplex links- Concepts of WAP technology.

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

LAN- base band and broad band Lan's - carrier sense networks-CSMA/CD -ring network- shared memory -IEEE802 standards-introduction to X-25. Transport layer- design issues- establishing and releasing connection - flow control – buffering - crash recovery - a simple transport protocol on X-25.

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

1. Computer Networks: Andrew S Tannenbaum, Pearson Education.
2. An Engineering Approach to Computer Networking: Keshav, Pearson Education.
3. Computer Networking: A Top Down Approach: Kurose Pearson Education.
4. Computer Network & Internet: Comer, Pearson Education.
5. Data communication: Hausly
6. Computer Networks, protocols standards & interfaces, Uyless Balack
7. Local Area Networks: William Stallings, Pearson Education.
8. Understanding Data Communication and networks- 2nd ed-William A Shay (Vikas Thomson Learning)

S 802 ANALYSIS AND DESIGN OF INSTRUMENTATION SYSTEMS 3 – 1- 0

Module 1

Design of the bridge Circuit for RTD- Cantilever and torque elements, Pillar load cell, Strain gauge accelerometer- Capacitive level sensor - Inductive push pull displacement sensor- Design of reference junction compensation and linearising circuit for thermocouple and thermistor- Design of charge amplifier-Instrumentation amplifier.

Module 2

Design of 2 and 4 wire transmitters with 4-20mA output- Smart transmitters- Design of pneumatic and electronic PID controllers-Design of ON-OFF controllers with neutral zone- Design of instrumentation servo mechanism- Design of annunciators - Low level and high level annunciators.

Module 3

Orifice meter- Design of orifice for a given flow condition- Design of rotameter- Zero and span adjustment in DP transmitter and temperature transmitter-Bourdon gauges-Factors affecting sensitivity- design of bourdon tubes- Design of square root extractors for variable head flow meters.

Module 4

Piping and instrumentation diagrams – ISA symbols – Process and instrumentation (PI)diagram of typical process plant – Preparation of instrumentation project – Process flow sheet – Instrument index sheet – Instrument specification sheet for pressure – Choice of temperature – flow – level – analytical instruments and control panels.

Module 5

Signals and noise in instrument systems – Statistical representation – pdf – psd – Auto correlation function – Effects of noise and interference – Series and common mode – Noise sources and coupling mechanisms – Multiple earths – Methods of reduction of noise – Shielding – Screening – Filtering – Modulation – Averaging – Auto correlation .

REFERENCES

1. Sheingold D. H.: Transducer interfacing hand book – a guide to analog signal conditioning, analog devices Inc masschusetts, 1980.
2. Anderson N A : Instrumentation for process measurement and control :Chilton book company 1980.
3. Barney.G.C.: Intelligent instrumentation – Microprocessor application in measurement and control, PHI, 1992.
4. Andrew w: Applied Instrumentation in process Industries; Vol. II. Gulf publications, 1990.
5. Johnson C.D: Process control instrumentation technology, 4/e, PHI, 1995.
6. Doebelin.E.O. Measurement systems applications and design, McGraw Hill, 1975.
7. ISA Handbook: ISA Publications, 1995.
8. John P. Bentley: Principles of measurement systems, Longman 1983.

ADVANCED MICROPROCESSORS

LAS 803 **3 -1- 0**

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

Intel 80386 Microprocessor
80386 Architecture and system connection – Real operating mode – 386 protected mode operation – segmentation and virtual memory – segment privilege levels and protection – call gates – I/O privilege levels – Interrupts and exception handling – task switching – paging mode – 80386 virtual 86 mode operation.

Module 5

Advanced Intel Microprocessors
80486 – Processor model – Reduced Instruction cycle – five stage instruction pipe line – Integrated coprocessor – On board cache – Burst Bus mode.
Pentium – super scalar architecture – u-v pipe line – branch prediction logic – cache structure – BIST (built in self test) – Introduction to MMX technology.

References

1. The Microprocessors, 6th Edition - Barry B. Brey Pearson Edu.
2. Microprocessor and Interfacing 2nd Edition - Douglous V. Hall TMH
3. The 80x86 family - John Uffenbeck

S 804 FIBER OPTICS & LASER INSTRUMENTATION 3 – 1- 0

Module 1

Theory and classification of fiber optics – Properties – Characteristics – Merits and demerits – Optical fiber production – Technology of preformed farication – Fiber drawing – Material consideration – Loss and bandwidth limiting mechanism – Mechanical and thermal characteristics – Light sources for fiber optics – Photo detectors – Source coupling - Fiber connection - splicing techniques.

Module 2

Fiber – system setup- Different types of modulators – Detectors – Application in instrumentation – Optic sensors – Pressure, Temperature , Displacement, Acceleration, Torque, Strain, Fluid level and viscosity – Electric and magnetic field sensors based on polarization effect.

Module 3

Laser rate equation – Three level system –Four level system properties of laser beams –Laser modes – Resonator configuration – Q switching – Model locking – Cavity damping single frequency operation – Types of lasers – Solid lasers – Liquid lasers – semiconductor lasers – Laser diodes.

Module 4

Laser for measurement of distance, length, atmospheric effect and pollutants – material processing – laser heating, melting, scribing, trimming, welding, material removal and vaporization – Calculation of power requirements of laser for material processing.

Module 5

Holography – Basic principles – Methods of holographic infermetry and application – Holography for non-destructive testing – Medical application of lasers – Laser and tissue interaction – Laser instruments for microsurgery, Removal of tumours of vocal chords, brain surgery, dermatology and oncology.

TEXT BOOKS

1. Keiser : Optical Fiber Communication systems, McGraw Hill Ltd, 1983.
2. D.C. Oshca and W. Rusel Callen: introduction to lasers and Applications, Addision Wesley, 1978.
3. H.M.Smith: Principles of Holography, John Wiley & sons 1975.
4. A.K. Ghatak and K. Thaiagarajan; Optical Electronics, Foundation Books 1991.
5. Morris Ticshler : Opto Electronics, Fiber Optics & Lasers A Text- Lab Manual, McGraw Hill, 2 edition 1992.
6. Charles K.Kato: Optical Fiber Systems: Technology, Design and Applications, McGraw Hill 1982.

ADVANCED MATHEMATICS (ELECTIVE - II)

CMELRTS 805-1 **3 – 1- 0**

Module 1 Green's Function

Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential 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 Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

Module 3 Gamma, Beta functions

Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

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

1. Linear Integral Equation: Ram P.Kanwal, Academic Press, New York
2. A Course on Integral Equations: Allen C.Pipkin, Springer, Verlag
3. Advanced Engg. Mathematics: H.K.Dass, S.Chand
4. Advanced Engg. Mathematics: Michael D.Greenberge, Pearson Edn. Asia
5. Numrical methods in Engg.&science: B.S.Grewal, Khanna Publishers
6. Generalized functions: R.F. Hoskins, John Wiley and Sons.
7. Principles and Techniques of: Bernard Friedman, John Wiley and sons Applied Mathematics
8. Principles of Applied Mathematics: James P.Keener, Addison Wesley.
9. Numerical methods: P.Kandasamy,K.Thilagavathy,K.Gunavathy, S.Chand & co

VHDL (ELECTIVE - II)

LAS 805-2 **3 - 1 - 0**

Module 1

Introduction: Hardware Abstraction- Basic Terminology- Entity Declaration- Architecture Body- Configuration Declaration- Package Declaration- Package Body- Model Analysis- Simulation- Basic Language Elements –Identifiers- Data Objects- Data Types- Operators.

Module 2

Behavioural Modelling: Entity Declaration- Architecture Body-Process Statement- Variable Assignment Statement- Signal Assignment Statement- Wait Statement- If Statement - Case Statement- Null Statement- Loop Statement- Exit Statement- Next Statement- Assertion Statement- Report Statement- Other Sequential Statements- Multiple Processes- Postponed Processes - Dataflow Modelling: Concurrent Signal Assignment Statement- Concurrent versus Sequential Signal Assignment- Delta Delay Revisited- Multiple Drivers- Conditional Signal Assignment Statement- Selected Signal Assignment Statement- the UNAFFECTED Value- Block Statement- Concurrent Assertion Statement- Value of a Signal

Module 3

Structural Modelling: Component Declaration- Component Instantiation- Resolving Signal Values - Generics and Configurations: Generics- Configurations- Configuration Specification- Configuration Declaration- Default Rules - Conversion Functions - Direct Instantiation- Incremental Binding.

Module 4

Subprograms and Overloading: Subprograms- Subprogram Overloading- Operator Overloading- Signatures- Default Values for Parameters - Packages and Libraries: Package Declaration- Package Body-Design File- Design Libraries-Order of Analysis- Implicit Visibility- Explicit Visibility.

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 Fi1e- 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- Modelling Regular Structures- Modelling Delays- Modelling Conditional Operations- Modelling Synchronous Logic- State Machine Modelling- Interacting State Machines- Modelling a Moore FSM- Modelling a Mealy FSM- A Generic Priority Encoder- A Simplified Blackjack Program- A Clock Divider- A Generic Binary Multiplier- A Pulse Counter- A Barrel Shifter- Hierarchy in Design.

Text Book

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

References

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

NEURAL NETWORKS (ELECTIVE - II)

AS 805-3 **3- 1- 0**

Module 1

Introduction - Principles - artificial neuron - activation functions - Single layer & multi-layer networks - Training artificial neural networks - Perception - Representation - Linear separability - Learning - Training algorithms.

Module 2

Back Propagation - Training algorithm - Applications - network configurations - Network paralysis - Local minima - temporal instability.

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

Hopfield nets - Recurrent networks - stability - Associative memory - applications - Thermo dynamic systems - Statistical Hopfield networks – Bi-directional associative memories - Continuous BAM - Adaptive resonance theory - Architecture classification - Implementation.

Text Book

1. Neural Computing Theory & Practice - Philip D. Wasserman.

References

1. Neural Networks - Simon Haykins
2. Adaptive Pattern Recognition & Neural Networks - Pay Y.H.
3. An Introduction to neural computing - Chapman & Hall
4. Artificial Neural Networks - Robert J. Schalkoff, McGraw Hill
5. Artificial Neural Networks - B.Yegnanarayana, PHI

S 805 – 4 VLSI TECHNOLOGY (ELECTIVE - II) 3 – 1- 0

Module 1

Process steps in IC fabrication: Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion of impurities- physical mechanism- Fick's I and II law of diffusion- Diffusion profiles- complementary (erfc) error function- Gaussian profile- Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, Fine line lithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation- patterning- wire bonding and packaging.

Module 2

Monolithic components: Isolation of components- junction isolation and dielectric isolation- Transistor fabrication- buried layer- impurity profile- parasitic effects- monolithic diodes- schottky diodes and transistors- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage (V_{th})- silicon gate technology- Monolithic resistors- sheet resistance and resistor design- resistors in diffused regions- MOS resistors- monolithic capacitors- junction and MOS structures- IC crossovers and vias.

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.
2. VLSI technology: S M Sze, Mc Graw Hill pub.
3. Basic VLSI design: Douglas Pucknell, PHI.
4. Principles of CMOS VLSI Design: H E Weste, Pearson Edn.
5. Integrated Circuits: K R Botkar, Khanna Pub.
6. CMOS circuit design layout and simulation: Barter, IEEE press.
7. Introduction to VLSI: Conway, Addison weslay.

S 805 - 5 INTELLIGENT CONTROL SYSTEM (ELECTIVE - II) 3 -1 -0

Module 1

Fundamentals &non recurrent networks : - Characteristics of artificial neural networks – Learning in biological systems and machine- Brain and computers – Differences – Types of artificial neural networks – Different learning rules – Types of activation functions –Training of artificial neural networks – Perception representation – Training algorithm. Multi layer perceptron- Back propagation training algorithm.

Module 2

Statistical methods and recurrent networks :- Statistical methods- training applications-Bolts man training-Cache training –Hopfield networks - Networks –Configuratio - Binary systems – Continuos systems – Hopfield network and Bolt Mann machine – Thermodynamic systems – Statistical Hopfield networks – Local minima – Speed energy function – Network capacity –Applications – A/D converter – Travelling sales man problem.

Module 3

Modern techniques for improving generalisation :- Associative memory - Bidirectional associative memory – Structure types – Encoding and retrieving adaptive resonance theory - ART architecture – ART classification – ART implementation – ART training – Characteristics recent trends in neural nets.

Module 4

Fuzzy logic control system : - Introduction - Review of crisp set theory – Basic concepts of fuzzy sets – Fuzzy logic operation on fuzzy relations – Fuzzy rules - Fuzzy logic controller – Fuzzification interface.- Knowledge base – Decision making logic de fuzzification interface.

Module 5

Neuro fuzzy logic control :- Adaptive fuzzy systems –Optimization of membership function and rule base of fuzzy logic controller using neural networks – Fuzzy neuron – Case studies of FLC for controlling temperature ,speed , flow chemical process and truck and trailer .

REFERENCES

1. Pd. Wasserman, Neural computing theory and practice, Van nortrand reinhld, Newyork, 1989
2. George K Klir and Tina A Folges, fuzzy sets, Uncertainity and information, PHI 1995
3. Jack M Zurada, Introduction to artificial neural systems, 1994.
4. James Freeman and David M Skapura, Neural networks, algorithams, applications and programming techniques, addision Wesley publishing co 1991

S 806 –1 INSTRUMENTATION IN PETRO CHEMICAL INDUSTRY 3 -1- 0
(ELECTIVE III)

Module1

Petroleum processing:- Petroleum exploration – Recovery techniques –Oil – Gas separation- Processing wet gases – Refining of crude oil.

Module 2

Unit operations in petroleum industry:- Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerization – Alkylation – Isomerization - Production of ethylene, Acetylene and propylene from petroleum .

Module 3

Chemicals from petroleum products :- Chemical from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

Module 4

Measurement in petrochemical industry: - Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of instruments.

Module 5

Control loops in petrochemical industry :- Process control in refinery and petrochemical industry- Control of distillation column - Control of catalytic crackers and pyrolysis unit- Automatic control of polyethylene production- Control of vinyl chloride and PVC production.

TEXT BOOKS

1. Waddams A.L, .Chemical from petroleum, Butter and Janner Ltd., 1968
2. Balchan.J.G. and Mumme K.I., Process Control Structures and Applications, Van Nostrand Reinhold Company, New York, 1988.

REFERENCES

1. Austin G.T.Shreeves, Chemical Process Industries, McGraw Hill International student edition, Singapore, 1985.
2. Liptak B.G. Instrumentation in Process Industries, Chilton Book Company, 1994.

S 806 – 2 LOGIC AND DISTRIBUTED CONTROL SYSTEM 3 – 1- 0
(ELECTIVE III)

Module 1

Review of computers in process control: Data loggers – Data acquisition system (DAS) – Alarms – Computer control hierarchy levels - Direct digital control- Supervisory digital control(SCADA)- Characteristics of digital data- Controller software- Linearization – Digital controller modes – Error – Proportional derivative and composite controller modes.

Module 2

Programmable logic controller(PLC) basics- Definition — View of PLC systems –Input /output modules – Power supplies – Isolate – General PLC programming procedures – Programming on /off outputs – Auxiliary commands and functions – Creating ladder diagrams from process control descriptions – PLC basic functions – Register basics functions – Counter functions.

Module 3

PLC intermediate functions – Arithmetic functions – Number comparison functions – Skip and MCR functions – Data move systems – PLC advanced intermediate functions – Utilizing digital bits – Sequencer functions- Matrix functions – PLC advanced functions – Alternate programming languages – Analog PLC operation –Networking of PLC – PLC functions - PLC installation – Trouble shooting and maintenance – Controlling a robot – Process with PLC –Design of interlocks and alarms using PLC.

Module 4

Interface and back plane bus standards for instrumentation systems – Field bus – Introduction – Concept – International – field bus – Standards – HART protocol – Method of operation – Structure – operating conditions and applications

Module 5

Distributed control system (DCS)- evolution of DCS - building blocks- detailed descriptions and functions of field control units – Operator stations – Data highways – Redundancy concepts – DCS supervisory computer tasks and configuration – DCS special requirement of networks used for control – Protocols – Link access mechanisms – Manufactures automation protocols –Case studies in DCS.

TEXT BOOKS

1. John W Webb, Ronald A Reis programmable logic controllers – principles and applications 3rd edition, Prentice hall 1995
2. Lucas M P distributed control system ,van nostrand reinhold co, Newyork 1986
3. Moore: Digital control devices, ISA press 1986
4. Hughes t : Programmable logic controllers, ISA press 1994

S 806 – 3 ROBOTICS AND AUTOMATION (ELECTIVE III) 3 -1- 0

Module 1

Basic concepts : - Definition and origin of robotics – Different types of robotics – Various generations of robots – Degrees of freedom – Asimov's laws of robotics – Dynamic stabilization of robots.

Module 2

Power sources and sensors : - Hydraulic, Pneumatic and Electric drives – Determination of HP of motor and gearing ratio – Variable speed arrangements – Path determination – Micro machines in robotics – Machine vision – Ranging – Laser – Acoustic – Magnetic, Fiber optic and tactile sensors.

Module 3

Manipulators, actuators and grippers : - Construction of manipulators – Manipulator dynamics and force control – Electronic and pneumatic manipulator control circuits – End effectors – U various types of grippers – Design considerations.

Module 4

Kinematics and path planning : - Solution of inverse kinematics problem – Multiple solution Jacobian work envelop – Hill climbing techniques –Robot programming languages.

Module 5

Case studies :- Mutiple robots – Machine interface – Robots in manufacturing and non-manufacturing applications – Robot cell design – Selection of robot**.**

TEXT BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

EMBEDDED SYSTEMS (ELECTIVE - III)

LAS 806-4 **3- 1 -0**

Module1 Overview of Embedded System

Embedded System, Categories of Embedded System, Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

Module2 Embedded Hardware & Software Development Environment

Hardware Architecture, Micro-Controller Architecture, Communication Interface Standards, Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems.

Module 3 Embedded Communication System

Serial Communication, PC-to-PC Communication, Serial Communication with the 8051 Family of Micro-controllers, Protocol Converter, Voice-over-IP, Embedded Applications over Mobile Network example MP3 Sound Player.

Module 4 Real Time & Database Applications

Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RTLinux System, Embedded Database Applications using examples like Salary Survey, Energy Meter Readings.

Module 5 Java Applications & Future Trends in Embedded Systems

Networked Java-Enabled Information Appliances, Embedded Process Control System, Mobile Java Applications, Appliance Control using Jini, System on a Chip (SOC), Smart Cards and the Cashless Society, Security in Embedded Systems.

Text Book

1. Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech

Reference

1. Fundamentals of Embedded Software where C and Assembly Meet – Daniel W Lewis.

DIGITAL IMAGE PROCESSING (ELECTIVE - III)

LAS 806-5 **3 -1 -0**

Module 1

Image representation and modeling - Characteristics of a digital image - Elements of digital image processing systems - Image digitizers & scanners - Elements of visual perception - Brightness & contrast - Image sampling & Quantisation - Two dimensional Sampling theorem - Reconstruction of image from its samples - Aliasing.

Module 2

Image Transforms - Two dimensional orthogonal & unitary transforms - Properties of unitary transforms - Two dimensional DFT & its properties – Cosine – Hadamard – Haar – Sine - KL Transforms & their properties.

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

Image Coding & Compression- basic principles - run length coding - variable length coding - bit plane coding - loss-less predictive coding - lossy predictive coding - Transform coding - Image compression standards.

References

1. Digital image Processing: I.Gonzalez Rafel C, Pearson Education.
2. Fundamentals of digital image processing: Jain Anil K, PHI.
3. Digital Image Processing: Pratt William K, John Wiley.

S 807 PROCESS CONTROL LAB 0- 0- 3

1. ON- OFF controller with neutral zone
2. Electronic PID controller and implementation of PID algorithm using high level language
3. Simulation of temperature control loop
4. Simulation of pressure control loop
5. Simulation flow control loop
6. Simulation of level control loop
7. Characteristics of Differential Pressure Transmitter and Rotameter
8. Characteristics of control valve, with and without positioner
9. Characteristics of I/P and P/I converter
10. Study of process control simulator
11. Study of PLC
12. PLC programming and implementation
13. Control of bottle filling system using PLC
14. Simulation of complex control systems using MATLAB package
15. Operation of computer controlled liquid level system
16. Operation of computer controlled thermal system
17. Study of Distributed Control System
18. Simulation of MIMO loops using DCS

PROJECT & SEMINAR

AS 808 **0 – 0- 3**

Each student is expected to prepare a report on the project work done by him/her and present a paper highlighting the work done by him/her in a seminar. The student is expected to complete the project work assigned to him/her and submit the project report by the end of semester.

VIVA – VOCE

AS 809 **0- 0- 0**

The students should prepare for an oral examination on Basic Circuit theory, Digital systems, Instrumentations, Computer Communication, Microprocessors, Industrial Electronics, Signal Processing etc.

(50 marks University exam)

Viva-Voce examination may be made based on Seminar, Projects, Industrial Visits, Industrial training and overall performance.

COMPARISON OF EI & AEI SYLLABUS OF M G UNIVERSITY

I The following subjects are the entirely new core subjects (Differing in title and contents) for the corresponding semesters.

V Semester	Electronic Instrumentation Transducer Engineering Control System-I
VI Semester	Industrial Electronics & Applications Process Instrumentation-I Process Control Control System-II
VII Semester	Process Instrumentation-II Analytical Instrumentation Data Acquisition & Communication Computer Control of Process
VIII Semester	Analysis & Design of Instrumentation Systems Fibre Optics & Laser Instrumentation

Total = 13 Subjects

II Lab/Practicals (entirely different)

V Semester	Linear Integrated & Digital IC Lab Transducers & Measurements Lab
VI Semester	Instrumentation Lab I
VII Semester	Instrumentation Lab II

Total = 4 Labs

III Lab/Practicals (different in content but bearing identical title)

VIII Semester	Process Control Lab

IV Electives (Entirely different)

Power Plant Instrumentation (VII SEMESTER)

Advanced Mathematics (VIII SEMESTER)

Intelligent Control System (VIII SEMESTER)

Instrumentation in Petro Chemical Industries (VIII SEMESTER)

Logic & distributed Control System (VIII SEMESTER)

Robotics & Automation (VIII SEMESTER)

Total = 6 Subjects

V Subjects appearing in different semester but having identical title & contents.

Subject	**EI**	**AEI**
Microprocessors & Micro controllers	V	VI
VLSI Technology	Elective VIII	VII (Core)