SEMESTER VIII

EI 801 INSTRUMENTATION SYSTEM DESIGN

MODULE I

Microcontrollers :Types and selection – Application example.
Microcontroller sources Family members, bus width program and data memory parallel ports, D/A and A/D converters, reset circuitry, watchdog timers, power – down considerations

MODULE II

Real – time control : Interrupt Structures programmable timers, real-time clock, latency, interrupt, density and interval constraints.

MODULE III

Programming Framework :CPU register, Structure, addressing modes, instruction sets, assembly languages, assemblers.

MODULE IV

Software building blocks : Queues, tables and strings, program organization, micro controller expansion methods, I/O hardware alternatives, development tools, and Motorola and Intel micro controller details

TEXT BOOKS

1. John, B.Peatman, 'Design with Micro-controllers', McGraw Hill International Ltd., 1989.
2. Michael Slater, 'Microprocessor – based design: A Comprehensive Guide to Effective Hardware Design', Prentice Hall, 1989.

REFERENCES

1. S.Yeralan and A.Ahluwalia, 'Programming and Interfacing the 8051 Micro controller', Addison Wesley, 1995.
2. Intel Manual on 16 bit – embedded controllers, 1991.
3. Motorola manual on 8 and 16 bit micro controllers.

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.
Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

El 802 BIOMEDICAL INSTRUMENTATION

MODULE I

Source of bio electric potential -resting and action potential -propagation of action potential- The bio electric potential- Electrodes for ECG , EEG and EMG- Micro electrodes

Bio medical recorders- electro cardio gram -lead systems -block diagram of ECG - EEG -EMG (Block diagram level treatment only)- Ink jet recorders- UV recorders

MODULE II

Therapeutic equipments – cardiac pacemaker – External and implant able pacemakers – power sources for implant able pacemakers leads and electrodes – cardiac defibrillators – implant able defibrillators – electro surgical machines

MODULE III

Imaging Systems -Basics of X-ray machines -Computed Tomography- MRI Systems -basic NMR components -Thermo graphic Equipment -Real time ultra sonic Imaging systems.

MODULE IV

Bio telemetry -Introduction -components -implant able units -single channel telemetry systems -multichannel wireless telemetry systems -transmission of analog physiological Signals over telephone

TEXT BOOKS

1. Bio medical Instrumentation and Measurements, Leslie Cromwell
2. Hand book of Bio medical instrumentation R.S. Khandpur
3. Principles of Bio medical Instrumentation, Richard Aston .

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

El 803 OPTOELECTRONIC INSTRUMENTATION

MODULE I

Interferometers -Fabry-Perot and Michelson interferometers -Mach-Zehnder interferometer - interference filters -interferometer methods in metrology and testing of optical components - optical spectrum analyzer -modulation of light -electro-optic effect -Kerr modulators -magneto-optic devices -acoustic optic modulators -display devices - light emitting diode -plasma displays -liquid crystal displays -pin diodes -photo detectors -thermal detectors -photon devices-optocouplers.

MODULE II

Optical materials and coating -moire fringes -photo elasticity -lasers -principles of operation - Einstein relations -population inversion -optical feed back -laser modes - classes. of lasers -solid state, gas and liquid dye lasers -semiconductors lasers - properties of laser light.

MODULE III

Optical resonators -Rectangular cavity -Open planer resonator -Quality factor Ultimate line width -Mode selection -Transverse & longitudinal -Q Switching -Mode Locking -Confoca1 resonator, Planar resonator -Spherical resonator

Optical Modulators: Electrooptic, Accousto optic, and Mechanooptic modulators - Theory, Principle of Operation, Construction and applications

MODULE IV

Applications of 1asers -laser gyro -Laser Doppler Anemometry (LDA) -holographic interferometry -distance measurement -holography -principles and applications - optical fibres - light guidance through fibres -step index and graded index fibres - multimode and single mode fibres -fibre fabrication

Measurement of fiber characteristics -attenuation, dispersion and refractive index profile measurement -OTDR -fiber optic components, Fibre losses, Fibre materials, Integrated Optics, couplers, splicers and connectors -applications of optical fibers - optical fiber communication - fiber optic sensors -recent trends

REFERENCE :

1. Meyer-ArelIrlt J.R.. "Introduction to Classical and Modern Optics", PHI
2. Wilson l. &:Hawkes l.F.B, "Optoelectronics: An Introduction", Prentice Hall of India
3 Thygarajan K. & Ghatak A. K., "Lasers -Theory and Applications" Plenum Press
4 Guimaraes ~.O.N. & Mooradian A., "Lasers and Applications", Springer Verlag.
5 Cock W .E. ,."Engg Applications of Lasers and Holography", Plenum Press.
6. Cheo P .K., .."Fibre Optics-Devices and Laser Systems", PHI.
7. Jain R.K., "Egineering Metrology", Khanna Publishers

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

CS/EC/EE/EI 804A - DIGITAL IMAGE PROCESSING

Module I

Digital Image Fundamentals : representation – elements of visual perception – simple image formation model – Image Sampling and quantization – basic relationships netween pixels – imaging geometry.

Review of matrix theory results: Row and column ordering – Toeplitz, Circulant and Block matrices. Review of Image transforms: 2D-DFT, FFT, Walsh, Hadamard, Haar, DCT and Wavelet transforms.

Module III

Image Enhancement : Spatial domain methods: Point processing – intensity transformations, histogram processing, image subtraction, inage averaging; Spatial filtering – smoothing filters, sharpening filters,. Freauency domain methods: low pass filtering, high pass filtering, homomorphic filtering. Generation of spatial masks from frequency domain specifications

Image Segmentation : Detection of discontinuities – point, line and edge and combined detection, Edge linking and boundary description – local and global processing using Hough transform- Thresholding- Region oriented segmentation – basic formulation, region growing by pixel aggregation, region splitting and merging – Use of motion in segmentation. Fundamentals of Representation and Description

Module III

Image restoration: Degradation model – Diagonalization of circulant and Block circulant matrices – Algebraic approaches – Inverse filtering – Wiener filter – Constrained Least squares restoration – Geometric transformations

Fundamentals of Colour image processing: Colour models – RGB, CMY, UIQ, HIS – Pseudo color image processing – intensity slicing, gray level to color transformation

Module IV

Image Compression: Fundamentals – redundancy: coding, inter pixel, psycho visual, fidelity criteria, Models, Elements of information theory, Error free compression – variable length, bit plane, lossless predictive, Lossy compression – lossy predictive, transform coding. Fundamentals of JPEG & MPEG & Fractal image compression techniques.

TEXT BOOK:

1. Gonzalez and Woods, Digital Image Processing, Pearson Education/Prentice Hall India Ltd., 2nd ed.

REFERENCES:

1. Anil K. Jian, Fundamentals of Digital Image Processing, Pearson Education/PHI Ltd, 2003
2. Mark Nelson, Jean-Loup Gailly, The Data Compression Book, BPB Publications, 2nd ed.
3. Pratt William K., Digital Image Processsing, John Wiley & Sons, 2nd ed.
4. Chands & Majumdar, Digital Image Processing and Analysis, PHI Ltd, 2003
5. M. Sonka, V. Hlavac, R. Boyle, Image Processing, Analysis and Machine vision, Thomson Learning, 2006

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

EI 804 B. ADVANCED ANALYTICAL TECHNIQUES

MODULE I

X-ray methods of analysis -Basic principles -Sources -Detectors X-ray absorption methods -X-ray fluorescence technique -X-ray diffraction methods -Electron probe microanalysis.

MODULE II

Electron and ion Spectroscopy -X-ray and UV photoelectron spectroscopy -ESCA - Electron impact spectroscopy -Auger electron spectroscopy -Ion scattering spectroscopy -Ion scattering spectroscopy -Rutherford back scattering -0 Principles - Instrumentation and analysis.

MODULE 111

Advanced topics in magnetic resonance spectrometry -Fourier transform techniques -: Nuclear quadruple resonance spectroscopy -Cl3 NMR- 2nd NMR -Advanced topics in ! mass spectrometry -Quadruple mass analyser.

MODULE IV

Electron microscopy- TEM = SEM -Principles, instrumentation and analysis, Scanning tunneling microscopy, Atomic force microscopy -Principles, instrumentation and analysis -Applications. Photoacoustic and photothermal spectrometers -Principles and instrumentation spectroflourimeters and phosphorimeters -Electrochemical instruments -Conductivity, meters -Coulometers -Amperometers -Radioochemical instruments.

REFERENCES:

1. Willard, Merrit, Dean and Settle -Instrumental Methods of Analysis -CBS. ;1
2. G. W. Ewing- Instrumental methods of chemical analysis -McGraw Hill.
3. A. Skoog and M. West -Principles of Instrumental analysis -Hall Sanders International
4. 4. R.S. Khandpur -Handbook of Analytical instruments - Tata McGraw Hill.

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

EC/EI 804 C ASIC DESIGN.

MODULE I

Introduction to ASICs: -Types of ASICs -Design flow -Combinational Logic Cell -Sequential logic cell- Data path logic cell -VO cells. Transistors as Resistors -Transistor Parasitic Capacitance-Logical effort.

Module II

Programmable ASICs: -Anti fuse -static RAM -EPROM and EEPROM technology -practical issues Programmable ASIC logic cells: Actel ACT -Xilinx LCA -Altera FLEX -Altera MAX. Programmable ASIC UO cells: DC & AC inputs and outputs -Clock & Power inputs .

Module III

Programmable ASIC interconnect: Actel ACT -Xilinx LCA -Altera MAX 5000 and 7000
Testing: Importance, Faults, Fault models, physical faults, Stuck at fault model, Logical faults, Fault collapsing, Fault simulation -serial fault simulation, parallel fault simulation, concurrent fault simulation. nondeterministic fault simulation, A TPG-D-Calculus, Basic A TPG algorithm, PODEM algorithm, controllability, observability.

Module IV

ASIC construction: System partition -FPGA partitioning -partitioning methods -Popular algorithms Floor planning and placement: physical design flow- algorithms. Routing: global routing -detailed routing -special routing -circuit extraction -DRC.

TEXT BOOKS ::

1. M.J.S .Smith, Application Specific Integrated Ci~cuits, Pearson Education ,1997.

REFERENCES:

1. Andrew Brown, VLSI Circuits and Systems in Silicon, McGraw Hill, 1991.
2. S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, Field Programmable Gate Arrays. Kluever Academic Publishers, 1992
3. Mohammed Ismail and Terri Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994
4. . S. Y. Kung, H. J. Whilo House, T. Kailath, VLSI and Modern Signal Processing, Prentice Hall lnc., 1985

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.
Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

EL 804 D. AUDIO AND VIDEO SYSTEMS

MODULE I

Audio Engineering: Audio frequency range -loudness -pitch -decibel -sound pick up devices microphones -types condenser -carbon -piezo electric -direction pattern - parameters of microphone: -frequency range- sensitivity -impedance-noise. Sound reproduction devices: loud speaker- typical specifications Production of speech signal: - Simple view of speech production - spectrogram Acoustics of speech production. Uniform tube model- discrete time model -vocal fold *I* Vocal tract interaction Characteristics of hearing -acuity threshold and masking of detection "

MODULE II

Speech coding and Compression:- companding- adaptive quantization -diferential and residual quantization -Vector quantization. Frequecy domain coding: Subband coding . Model based coding: linear predictive coding -VQ LPC coder. MPEG : Block diagram of audio encoder decoder. Recording of sound: recording media- magnetic -optical storage systems Coding and decoding applied to CD

MODULE III

Video Engineering: Elements of Television system:- Basic block schematic of television transmitter and receiver, camera , picture tube, Scanning, human factor consideration, flicker, interlaced scanning, number of scanning lines, Horizontal and vertical resolution, maximum video frequency. resolution and bandwidth, Composite video signal -vertical and horizontal synchronization Television camera: -Working principle of CCD- its working -Color television camera: block schematic explanation Modulation -Positive and negative modulation and its comparison, high leve1 and low level modulation and its
comparison. vestigial side: band transmission. transmission of sound signal.

MODULE IV

Colour Television: Compatibility consideration, Color response of human eye, Three color theory, additive mixing of colors, chromaticity diagram, Luminance and chrominance, color difference signal and its generation, Frequency interleaving and Colour burst signal Colour TV picture tubes: CRT, LCD and plasma displays. Monochrome and colour reception: Detailed block schematic -Block schematic explanation Basic colour television systems: PAL and NTSC - Block schematic explanation

REFERENCES

1. Multi Media Communication Fred Halsal Pearson Education
2. Basic Television Engineering: Bernad Grob, Mc Graw Hill.
3. Monochrome and colour television: R R Gulati, Wiley Eastern
4 Discrete time Speech Signal Processing :Thomas Quatieri, Pearson Education
5. Digital Communication, B salkar :Pearson Education
6. The Electronics Hand Book :J C Whitaker IEEE press

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.
Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

EI 804 E. ADVANCED BIOMEDICAL INSTRUMENTS

MODULE I

Heart-Iung machine -Artificial heart valves -Pacemakers and Defibrillators - Anaesthesia machine -0 .Blood cell counter -digital thermometer -Audiometer - Electron Microscope -up based ventilator biomaterials.

X-ra machine -:- Radiography, fluoroscopy -image intensifiers -Conventional X-ray Imaging - Angiography -Computed tomography -linear tomography -tomography scanner- applications.

Magnetic Resonance Imaging systems -Basic NMR components.

MODULE II

Ultrasonic imaging systems -Physics of ultrasonic waves, medical ultrasound. construction of an ultrasonic transducer. different modes of operations of ultrasound -A scan, B scan - Echocardiograph (M mode), Real time ultrasonic imaging system, Computer controlled ultrasonic imaging -Applications.

MODULE III

Laser application in machine -Laser- Pulsed Ruby Laser, Nd- AG laser, Argon Laser, CO2 laser, Helium-neon laser -applications -Advantages of laser surgery -Laser based Doppler blood flow meter- Endoscope -Cardio scope -Laproscope -Endoscopic laser coagulator cryogenic surgery.

Medical thermography- Physics of themography.

MODULE IV

Medical thermography -Physics of theromography -Them1ographic equipment Quantitative medical thermography -Infrared, Liquid crystal and Microwave

Thermography- Medical applications of thermography.

Computer applications in Medicine -Computer aided ECG analysis -Computerized Catheterisation Laboratory -Computerised Patient monitoring system..

REFERENCE:

I. Leslie Cromwel] -Biomedical instrumentation and measurements -Prentice Hall.

2. L.A. Geddes and L.E. Baker -Principles of Applied biomedical instrumentation -John Wiley and sons.

3. B. Jacobson and J.G. Webster -Medicine and Clinical Engineering -Prentice Hall of. India

4. Macka SturatBiomedical telemetering- John Wiley.

5. R.S. Khandpur -Handbook of biomedical engineering -Tata McGraw Hill.

Type of Questions for University Exam.

Q.1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.2 to Q.5: Two questions A & B of 15 marks from each module with option.

EI 805 PROJECT WORK

Each batch or students shall develop the project designed during the VII semester. The implementation phase shall proceed as follows:

a) For hardware projects, practical verification of the design, PCB design, fabrication, design analysis and testing shall be done.
b) For software projects, a proper front end (GUI) if applicable, shall be designed. A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shall be done.
c) .Integration of hardware and software, if applicable, shall be carried out.
d) .A detailed project report in the prescribed format shall be submitted at the end of the semester.
e) All test results and relevant design and engineering documentation shall be included in the report
f) .The work shall be reviewed and evaluated periodically.

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.

a) . Presentation of the work .
b) Oral examination
c) Demonstration of the project against design specifications .
d) Quality and Content of the project report

Guidelines for evaluation:

Regularity and progress of work	30
knowledge and Involvement	100
End semester presentation and oral examination	50
Level of Completion and demonstration of. functionality specifications	70
Project Report -Presentation style and Content	50
Total	300 marks

Note: Points (i) and (ii) to he evaluated by the respective project guide and the project Coordinator based on Continuous evaluation. (iii)-(v) to he evaluated by the final evaluation team Comprising of 3 internal examiners including the project guide.

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EI 806 VIVA -VOCE

Each student is required to appear for a viva-voce examination at the end of the complete course work. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners. The examination panel shall comprise of one internal examiner and one external examiner, both appointed by the University. The examiner shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field.