ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH.
EIE

(Applicable for the batches admitted from 2011-2012)

VNR VIGNANA JYOTHI
INSTITUTE OF ENGINEERING & TECHNOLOGY
(AFFILIATED TO JNTUH)
An Autonomous Institute under JNTUH

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Academic Regulations 2011 For M.Tech. Degree Course
(Effective for the students admitted into first year from the academic year 2011-2012)

1. Introduction

Academic Programmes of the institute are governed by rules and regulations as approved by the academic council of the institute.

These academic rules and regulations are effective from the academic year 2011-12, for the students admitted into two year post graduate programme offered by the college leading to Master Of Technology (M. Tech.) degree in the disciplines viz., Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer science and Engineering, Information Technology, Electronics and Instrumentation Engineering and Automobile Engineering.

The M.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program after fulfilling all the requirements for the award of the Degree.

1.1 Eligibility for Admissions

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time. Admissions shall be made on the basis of GATE Rank and merit rank obtained by the qualifying candidate at an Entrance Test conducted by the University, subject to reservations prescribed by the university/ State Government from time to time.

2. Courses of Study

The following specializations are offered at present for the M.Tech. Course of study.

1. Advanced Manufacturing Systems
2. Highway Engineering
3. Structural Engineering
4. Power Electronics
5. Software Engineering
6. VLSI System Design
7. Embedded Systems
8. Geotechnical Engineering
9. Electronic Instrumentation
10. Automation

and any other course as approved by the Academic Council of the Institute and the authorities of the University from time to time.

2.1 Departments offering M.Tech. Programmes with specializations are mentioned below:

ME	1.Advanced Manufacturing Systems 2. Automation
CE	1. Highway Engineering 2.Structural Engineering 3 Geotechnical Engineering
EEE	Power Electronics
CSE	Software Engineering
ECE	1.VLSI System Design 2.Embedded Systems
EIE	Electronic Instrumentation

3. Attendance

Each academic year shall be divided into two semesters, each of 90 Instructions days, excluding examination, evaluation, declaration of results etc.

3.1 A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 75% of attendance in that subject.

3.2 Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by the College Academic Committee on genuine and valid reasons on application by the candidate with supporting evidence.

3.3 A candidate shall get minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

3.4 Shortage of attendance below 65% shall in no case be condoned.

3.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

3.6 In case the candidate secures less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register the subject when next offered.

4. Evaluation

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

4.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the better of the marks secured in the two Mid Term-Examinations conducted one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for duration of 2 Hours with 4 questions to be answered out of 6 questions.

4.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations, 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

4.3 There shall be two seminar presentations during the I year, one in each semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

4.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva- Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects studied during the M.Tech. course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-Voce.

4.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

4.6 A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and he has failed in the end examination. In such a case candidate may re-register for the subject(s) and secure required minimum attendance. Attendance in the re-registered subject(s) has to be calculated separately to become eligible to write the end examination in the re-registered subject(s). Re-registration for the subjects is allowed only if that particular re-registration subjects are the hindrance for the award of Degree. Re-registration is allowed in this case provided the student doesn't have any subject(s) yet to pass other than the re-registration subjects with prior permission.

4.7 Laboratory examination for M.Tech. courses must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be a teacher of same specialization either external or from the same dept.

5. Evaluation of Project / Dissertation Work.

5.1 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

5.2 A Project Review Committee (PRC) shall be constituted with at least four members namely HOD, PG Coordinator of the Department, project supervisor and one senior faculty member of same specialization.

5.3 After satisfying 5.1, a candidate has to submit, in consultation with the project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for its approval. Only after obtaining the approval of Departmental Academic Committee, the student can initiate the Project work.

5.4 If a candidate wishes to change his supervisor or topic of the project he can do so with the approval of Departmental Academic Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

5.5 Internal Evaluation of the project shall be on the basis of the seminars(Project reviews) conducted during the II year by the committee consisting of Head of the Department, project supervisor ,PG coordinator of the Department and senior faculty member of the Department. belonging to same specialization. A candidate shall submit status report in a spiral bound copy form.

5.6 The work on the project shall be initiated in the beginning of the second year and the duration of project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 240 days from the date of registration of the project work. For the approval of PRC the candidate shall submit the daft copy of thesis to the Head of the Department (Through project supervisor/PG coordinator) and shall make an oral presentation before the PRC.

5.7 After approval of PRC, every student has to submit three copies of the Project Thesis certified by the supervisor to the Department.

5.8 The thesis shall be adjudicated by one examiner selected by the Chief Superintendent. For this, HOD shall submit a panel of 3/ 5 examiners, who are eminent in that field with the help of the concerned guide.

5.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, within the time frame as described by PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

5.10 If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. The candidate has to secure any one of the grades as Excellent, Good or Satisfactory on his thesis/dissertation and viva-voce. If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, he has to reregister the project work as in clause 5.1. However, the candidate may select a new guide and new topic with the approval of the PRC and submit the project report with a minimum of 240 days from the date of re-registration. Of course this shall not prejudice the clause 6.1 below. The candidate can be permitted to change the topic/guide only once.

6. Award of Degree and Class

A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and completes it successfully for not less than two academic years and not more than four academic years.

6.1 A student, who fails to fulfil all the academic requirements for the award of the degree within four academic years from the year of his admission, for any reason whatsoever, shall forfeit his seat in M.Tech. Course.

6.2 After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

7. Withholding of Results

If the candidate has not paid any dues to the Institute or if any case of indiscipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The issue of the degree is liable to be withheld in such cases. This delay shall not prejudice clauses Nos.6.0 and 6.1

8. Transitory Regulations

Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered without precluding clauses Nos.6.0 and 6.1

9. General

9.1 The academic regulations should be read as a whole for purpose of any interpretation.

9.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

9.3 The Institute may change or amend the academic regulations and syllabi at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the Institute.

9.4 Wherever the words he, him or his occur, they will also include she, her and hers.

10. Supplementary Examination

Supplementary examinations will be conducted along with regular semester end examinations. Supplementary examinations will be conducted to a maximum number of four continuous times subsequent to the revision of the syllabus. Supplementary examinations will be conducted in the equivalent courses as approved by the Institute Academic Committee.

Vignana Jyothi Institute of Engineering & Technology
M.TECH. (ELECTRONICS & INSTRUMENTATION)

I Year - I SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	T/P/D	Credits
R11EAI 2101		Transducers And Applications	3	0	3
R11EAI 2102		Signal Conditioning Circuits	3	0	3
R11 EAI2103		Process Control Instrumentation	3	0	3
R11 EAI2104		Analytical Instrumentation	3	0	3
R11 EAI2105 R11 EAI2106 R11 EAI2107	Elective – I	Digital Control systems Real Time and Embedded Systems Fiber Optic and Laser Based Instrumentation	3	0	3
R11 EAI2108 R11 EAI2109 R11 EAI2110	Elective - II	Biomedical Instrumentation Digital Image processing Instrumentation for Environmental Analysis	3	0	3
R11 EAI2201	Lab	Instrumentation Laboratory	0	3	2
R11 EAI2301		Seminar	--	--	2
		Total Credits (6 Theory + 1 Lab)			**22**

I Year - II SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	T/P/D	Credits
R11 EAI2111		Data Acquisition System	3	0	3
R11PES2118		Reliability Engineering	3	0	3
R11 EAI2112		Microcontrollers and PC Based Instrumentation	3	0	3
R11 EAI2113		Virtual Instrumentation	3	0	3
R11 EAI2114 R11 EAI2115 R11 EAI2116	Elective – III	Power Plant Instrumentation Robotics Design and Control MicroElectro-Mechanical Systems	3	0	3
R11 EAI2117 R11PES2114 R11 EAI2118	Elective - IV	Intelligent Instrumentation Neural Networks & Fuzzy Systems Instrumentation and Control in Paper & Pulp Industries	3	0	3
R11 EAI2202	Lab	Virtual Instrumentation Laboratory	0	3	2
R11 EAI2302		Seminar	--	--	2
		Total Credits (6 Theory + 1 Lab)			22

* **T/P/D: Tutorial/Practical/Drawing Practice**

VNR Vignana Jyothi Institute of Engineering & Technology
M.TECH. (ELECTRONICS & INSTRUMENTATION)

IIYear - I SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	T/P/D	Credits
R11EAI2303		Comprehensive Viva	0	0	2
R11EAI2304		Project Seminar – I	0	3	2
R11EAI2305		Project Work	0	0	18
		Total Credits			22

II Year - IISEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	T/P/D	Credits
R11EAI2306		Project Work	0	0	20
R11EAI2307		Project Seminar – II	0	0	2
		Total Credits			22

* **T/P/D: Tutorial/Practical/Drawing Practice**

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem

L	T/P/D	C
3	0	3

(R11EAI 2101) TRANSDUCERS AND APPLICATIONS

Unit – I : Introduction to Measurement Systems

General concepts and terminology, measurement systems, sensor classification, static characteristics of measurement systems-accuracy, linearity, resolution, precision and sensitivity etc. estimation of errors. Dynamic characteristics of measurement systems. Zero-order first-order and second-order measurement systems and response.

Unit – II : Measuring devices:

Displacement

Resistive Potentiometer, Resistive strain gauges inductive displacement transducer, Capacitive Displacement Transducers, Piezo Electric Transducers, Ultrasonic Methods.

Temperature

Thermal expansion methods, Thermo electric, radiation methods-thermal and photon detectors based thermometers.

Unit – III: Measuring devices:

Pressure

Methods of pressure measurement: Dead weight gauges and manometers, elastic transducers, high pressure measurement.

flow

Anemometers, velocity sensors obstruction meters, averaging Pitot tubes, Rota meters, Electromagnetic, Vortex shedding, Ultrasonic Flow meters.

Unit – IV : Unit – V: Measuring devices

Velocity and acceleration:

Seismic displacement, velocity and acceleration pickups (Accelerometers). Gyroscopic angular displacement and velocity sensors.

Force and Torque:

Methods of force measurement and characteristics, Bonded strain gauge, Variable Reluctance, Piezo Electric Transducer, Torque measuring on rotating shafts.

Unit – V: Measuring devices

Humidity, Density and Radiation measurement

Capacitive Impedance and Piezoelectric Hygrometers.
Differential Pressure, U-tube and ultrasonic Densitometers. pH measurement: Ion Selective Type.
Radiation Fundamentals-Radiation Detectors-Radiation Thermometers. Optical Pyrometers.

Digital Sensors

Position encodes, variable frequency sensors-quartz digital thermometer, SAW sensors, digital flow meters, sensors based on semiconductor junctions: thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, charge-coupled sensors.

Text Books:

1. Measurement Systems, E.O. Doeblin, Mc-Graw Hill Publication
2. Transducers and Instrumentation, D.V.S. Murthy, PHI Publication
3. Sensors & Transducers, D. Patranbis, Wheeler Publishing
4. Sensor Technology Handbook - Jon S. Wilson, Elsevier Publications

References:

1. Instrument transducers, H.K.P Neubert, Oxford University Press.
2. Process Measurement and Analysis, B.G. Liptak, ISA Publication IVth edition
3. A Text Book of Mechanical Measurements and Instrumentation, A.K. Sawhney.
4. Mechanical Measurements, E.O. Doeblin, Mc-Graw Hill Publication.
5. Transducer Engineering, Ranganathan.S, Allied Publishers.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem **L T/P/D C**

3 0 3

(R11EAI 2102) SIGNAL CONDITIONING CIRCUITS

Unit I:

Instrumentation amplifiers-Differential Amplifiers, Instrumentation Amplifiers based on two op amps, Instrumentation Amplifiers based on three op amps, Monolithic Instrumentation Amplifiers, **Interference**-Interference types and reduction, Signal circuit grounding, shield grounding, Isolation amplifiers.

Unit II:

Carrier Amplifiers- Fundamentals and structure, Phase sensitive detectors, Application to LVDTs**, Resolver-to-digital Converters and Digital-to-resolver converters**- Synchro-to-resolver converters, Digital-to-resolver converters, Resolver-to-digital Converters, Chopper and low-Drift amplifiers, Electrometer Amplifiers, Charge Amplifiers, Noise in Amplifiers.

Unit III :

Chopper and Low-drift Amplifiers-Offset and drift in op amps, chopper amplifiers, chopper- stabilized amplifiers, auto-zero amplifiers, offset and drift in instrumentation amplifiers. **Electrometer Amplifiers, Charge Amplifiers, Noise in Amplifiers**-noise in op-amps, noise in instrumentation amplifiers.

Unit IV:

PLL , ADC and DAC Circuits:PLL – Introduction, block schematic, principles and description of individual blocks, voltage controlled oscillator, monolithic PLL, applications of PLL: frequency multiplication and division frequency translation, AM detection, FM detection, FSK demodulation. ADC and DAC: Basic principles - techniques - their characteristics.

Unit V : Introduction to Digital Signal Conditioning

Introduction, Digital Filters and Z-transforms, Some Simple DSP Algorithms, **Discrete and Fast Fourier Transforms and their Applications**-Use of Data Windows to improve Spectral Resolution, Use of the DFT to Characterize Random Signals and Noise, The Fast Fourier Transform, DSP Coprocessor Boards, **Digital Routines for Interpolating Discrete Data**- Estimating Missing data at the sampling Instants

Text Books

1. Ramon Palls Areny, John G.Webster **Sensors and Signal Conditioning** second edition, John Wiley and Sons, 2000
2. Roy Choudhury and Shail Jain., **Linear Integrated Circuits**, Wiley Eastern Ltd., 1991.

Reference Books

1. Robert B.Northrop **Introduction to Instrumentation and measurement-**second edition-Taylor &Francis group
2. William David Cooper and Albert D. Helfrick.,: " Electronics Instrumentation and Measurement Techniques", Prentice Hall of India Pvt., Ltd., 1986

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem **L T/P/D C**

3 0 3

(R11 EAI2103) PROCESS CONTROL INSTRUMENTATION

Unit-I: Process Dynamics

Introduction to process control – Types of Processes, Process variables, Load variables, Dynamics of Flow, Pressure, Level and Temperature Processes, Mathematical modeling for process control application, interacting and non interacting loops.

Control Actions And Controller Tuning Basic control actions-on/off, P, P+I, P+I+D, floating control-pneumatic and electronic controllers- controller tuning-time response and frequency response methods

Unit – II : Final Control Elements Actuators – Positioners – Control Valve– characteristics – valves bodies – valve sizing – selection factors – valve rangeability – cavitation and flashing.

Complex Control Techniques

Feed forward – Ratio – Cascade – Split range – Inferential – Predictive – Adaptive and Multivariable control.

Unit – III : Control Of Thermal Systems:

Dynamics and control of Heat Exchanger – Distillation Column.

Unit – IV : Programmable Logic Controllers:

Evolution of PLC – Sequential and Programmable controllers – Architecture – Programming of PLC – Relay logic and Ladder logic – Functional blocks .

Distributed Control System.

Evolution of DCS – Architecture – Local control unit – Operator interface – Engineering interface – Display – Case studies in DCS.

Unit – V : Advanced Process Control Applications:

Development of control loops – Design aspects of Instrumentation for Power, Water, and Waste-Water treatment. Food and Beverages, Pharmaceuticals (Introduction to international standards S88, S95) Cement, automobile and Building Automation.

Text Books:

1. Process control, Harriot P., Tata MCGraw Hill Publishing Co., New Delhi, 1991.
2. Curtis Johnson, Process Control Instrumentation Technology, Prentice Hall India.
3. Doeblin E.O Measurements systems Applications and Design Mc.Graw Hill
4. K.Ogata, Modern Control Engineering, Prentice Hall India.
5. Process Control, Bela G. Liptak.
6. George Stephanopolus, "Chemical Process Control", Prentice Hall India
7. Norman A Anderson," Instrumentation for Process Measurement and Control" CRC Press LLC, Florida, 1998.
8. Dale E. Seborg, Thomas F Edgar, Duncan A Mellichamp, "Process dynamics and control", Wiley John and Sons, 1989.
9. Marlin T.E., "Process Control", Second Edition McGraw hill, New York, 2000.
10. Balchan J.G. and Mumme G., "Process Control Structures and Applications", Van Nostrand Renhold Co., New York,1988.
11. Lucas M.P, "Distributed Control System", Van Nostrand Reinhold Co. NY 1986
12. Pertrezeulla, "Programmable Controllers", McGraw-Hill, 1989

References:

1. Instrumentation for process Measurement and Control, Norman A Anderson, CRC Press LLC, Florida, 1998.
2. Process Dynamics and Control, Dale E. Seborg, Thomas F.Edgaar, Duncan A. Mellichamp Wiley John And Sons, 1989.
3. Process Control, Second edition, Marlin T.E., McGraw Hill, New York, 2000
4. Process Control Structures and Applications, Balchan J.G. and Mumme G., Van Nostrand Renhold Co., New York, 1998.
5. Process Control Systems ,F.G.Shinskey, TMH.
6. Computer based Industrial Control, Krishna Kant, PHI.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem **L T/P/D C**

3 0 3

(R11 EAI 2104)ANALYTICAL INSTRUMENTATION

Unit I: Electrochemical Instruments

Basic concepts of Analytical instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers using Polarographic principle – sodium analyzer- silica analyzers– Polarographic Instruments.

Unit II: Absorption Spectrophotometers-I

UV, VIS spectrophotometers – single beam and double beam instruments – instrumentation associated with the above spectrophotometers – sources and detectors ,IR SPM– sources and detectors for IR spectrophotometers, FTIR.

Emission Spectrophotometers-II

Flame emission and atomic absorption spectrophotometer – Atomic emission spectrophotometer – sources for Flame Photometers and online calorific value measurements**.**

Unit III: Gas and Liquid Chromatographs

Basic principle of gas chromatography, liquid chromatography, HPLC different types of columns, detectors, recorders and associated equipment, Salient features of liquid chromatography, Detectors used, applications of high pressure liquid chromatography

Unit IV: Gas Analyzers-I

Flue gas analysis using thermal conductivity principle, Katharometer – oxygen analyzers using paramagnetic principle, Zirconium oxide cells, Pollution Monitoring Instruments.

Gas Analyzers-II

CO monitors – Nox analyzer – H2S analyzer system – Industrial analyzer circuits

Unit V: Principle of Nuclear Magnetic Resonance

Instrumentation associated with NMR spectrophotometer – Introduction to mass spectrophotometers, Principle and brief discussion on ELECTRON SPIN RESONANCE (ESR)

Nuclear Radiation Detectors

GM counter, Scintillation counter, Ionization chamber – Solid state detector, Gamma Spectrometry, Industrial application of radiation measurement

Text Books:

1. Analytical Instrumentation , R.S. Khandpur
2. Instrumental Method of Analysis Willard, Merrit, Dean, D.Van Nostrand
3. Principles of Instrumental Analysis , Skoog D.M and West D.M, Helt Saunder publication

References:

1. Process Measurement and Analysism B.G. Liptak, CRC Press
2. Instrument Technology, E.B. Jones, Butterworth Scientific Publications.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem

L	T/P/D	C
3	0	3

(R11 EAI2105) DIGITAL CONTROL SYSTEMS
(ELECTIVE - I)

Unit – I Sampling,Reconstruction &Z-Transforms

Introduction, sample and hold operations, Sampling theorem, Reconstruction of original sampled signal to continuous-time signal. Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms. Z-plane analysis of discrete-time control system Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane: Primary strips and Complementary Strips.

Unit -II State Space Analysis

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

Unit-III Controllability, Observability & stability analysis

Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.
Stability Analysis of closed loop systems in the Z-Plane. Jury stablility test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems.

Unit-IV Design Of Discrete Time Control System By Conventional Methods

Design of digital control based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers. Design digital control through deadbeat response method.

Unit -V State Feedback Controllers, Observers and quadratic regulators

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order and Reduced order observers. Min/Max principle, Linear Quadratic Regulators, Kalman filters, State estimation through Kalman filters, introduction to adaptive controls.

Text books:

1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI, 2nd Edition
2. Digital Control and State Variable Methods by M.Gopal, TMH

Reference books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Engineering, M.Gopala

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem

L	T/P/D	C
3	0	3

(R11 EAI2106) REAL TIME AND EMBEDDED SYSTEMS (ELECTIVE-I)

Unit I : Introduction

Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

Unit II:

General Purpose Processors and Communication Interface

Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.

Unit III : Introduction to RTOS and Basic Design

Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals

Principles, Semaphores and Queues, Hard real time scheduling considerations, Saving memory and power an example RTOS like µC – OS (Open Source) Embedded S/W Development tools.

Unit IV :: Real Time Operating Systems

Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

Unit V : Design Technology

Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

Text Books

1. Embedded System Design – A Unified Hardware/Software Introduction – Frank Vahid, Tony D. Givargis, John Wiley, 2002.
2. Embedded / Real Time Systems – KVKK Prasad, Dreamtech Press, 2005.

References

1. Embedded Microcomputer Systems – Jonathan W. Valvano, Brooks / Cole, Thompson Learning.
2. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.
3. Introduction to Embedded Systems – Raj Kamal, TMS, 2002.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – II sem

L	T/P/D	C
3	0	3

(R11 EAI2107) FIBER OPTIC AND LASER INSTRUMENTATION
(ELECTIVE - I)

Unit -I: Optical fibers and their properties

Introduction to Optical Fibers - principles of light propagation through a fiber – Different types of fibers and their properties –Transmission characteristics of optical fiber –Absorption losses – Scattering losses –Dispersion - advantages and disadvantages of optical fibers

Light sources for fiber optics, photo detectors, source coupling, splicing and connectors.

Unit-II: Laser Fundamentals

Fundamental characteristics of Lasers – Three level and four level lasers – Properties of Laser and Laser modes – Resonator configuration – Q-switching and Mode locking – Cavity dumping – Types of lasers: Gas lasers, Solid lasers, Liquid lasers – Semi conductor lasers.

Unit-III: Industrial Applications of Optical fibers

Fiber optic sensors – Fiber optic Instrumentation system - Interferometric method of measurement of length - Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain. Fiber optic gyroscope – polarization maintaining fibers - applications.

Unit-IV: Applications of Lasers

Industrial applications of lasers – Laser Doppler Velocity meter – Laser heating- Medical Applications Lasers - Laser and Tissue interaction, Laser instruments for surgery, Removal of tumors of vocal cords, Brain surgery, Plastic surgery, Gynecology, Oncology, Dermatology and Ophthalmology. Holography – Basic principle; methods, Holographic Components, Holographic Interfercmetry and Applications, Holography for Non-destructive Testing

Unit-V: Opto-Electronic Components

Magneto Optic and Acoustic – optic and other types of Optical Modulators – Detectors – Application in Instrumentation

Text Books:

1. Industrial Applications of Lasers, John F ready, Academic Press 1978
2. Laser Applications, MonteRoss, McGraw Hill, 1968
3. Semi Conductor Opto-electronics, Jasprit Singh, McGraw Hill, 1995
4. Optical Electronics Foundation Book, Ghatak A.K. and Thiagarajar K, TMH, New Delhi, 1991
5. Industrial Lasers and their Applications, John and Harvy Industry, Academic Press.
6. Lasers and Applications, Guimaran W.O.N & Mooradian A, - Spinger Verlag.
7. Laser Electronics, Verdeyn JT, - Prentice Hall.
8. Lasers in Industries, Charaschan SS, Van

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(R11 EAI 2108) BIOMEDICAL INSTRUMENTATION
(ELECTIVE II)

Unit-I : Introduction to Biomedical Instrumentation:

Bio Potential – Resting and Action potentials. Electrodes – Different types of electrodes – for ECG, EEG, EMG – Equivalent circuits for electrodes – General and Smart Sensors used in Biomedical – Selection Criteria for Transducers and Electrodes for Bio Medical applications – Design of low noise isolation pre amplifiers – Differential Amplifiers including Op.Amps and Instrumentation Amplifiers – Chopper amplifiers – Electrical safety – Grounding and isolation.

Unit-II : Elecro-Physiological Measurements:

Electro Cardiograph (ECG) – Electro Encephalographic (EEG) – Electromyography (EMG) – Vector Cardiography – Echocaaardiography, Phonocardiography (PCG), Electroretinography (ERG) – Electrocculograph (EOG).

Cardiac Instrumentation: Blood pressure and Blood flow measurement.

Specification of ECG machine. Einthoven triangle, Standard 12-lead configurations,

Interpretation of ECG waveform with respect to electro mechanical activity of the heart.

Unit-III: Assisting and Therapeutic Devices:

Cardiac pacemakers – Defibrillators – Heat lung machine – Muscle stimulator–Limp pros-thetics – Diathermy – Introduction to artificial kidney – elements of audio and visual aids in Biomedicine, Blood flow meters, Ultra Sonography; Automated Drug injecting systems

Unit-IV: Modern Imaging Techniques:

X-ray Machine – Computer tomography (CT) – Magnetaic resonance Imaging system – Ultrasonic Imaging system – Applications of Lasers in biomedicine. IR (Thermographic) Imaging, and its diagnostic criteria.

Unit-V:Audiometers:

Basic audiometer, Pure tone audiometer, Speech audiometer, audiometer system Bekesy, Evoked response audiometry system.

Measurement and Analysis Techniques:

Blood Gas Analysers-Blood PH measurement, blood Pco2 measurement-Oximetry-Blood cell counters-Coulter counters, Automatic recognition and differential counting of cells.

Text Books:

1. Hand book of Biomedical Instrumentation, Khanpur R.S., Tata McGraw Hill, 1996.
2. Biomedical Insstrumentation and Measurements, Cromwell L., Prentice Hall of India, 1995.
3. Principle of Applied Bio-medical Instrumentation, Geddes and Baker, John Wiley and Sons, 1975.

References:

1. Feyman Lectures on Physics Vol 2, Richard P. Feyman, Robert B. Leighton and Matahew Sands – Narosa Publications.
2. Medical Imaging Systems – Albert Macovski – Prentice Hall.
3. Application & Design of Medical Instrumentation , John G. Webster, John Wiley & Son.
4. Medical Instrumentation – Applications and Design Honghton Miffince – Bosten

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(R11 EAI 2109) DIGITAL IMAGE PROCESSING
(ELECTIVE - II)

Unit I : Introduction

Fundamentals steps of Image processing, Components of an Image processing system, Image sampling and quantization, relationship between the pixels. Gray level transformation, Smoothing and sharpening spatial filters, Smoothing and sharpening frequency domain filters, Homo morphic filtering.

Image Transforms

2-Dimensional Orthogonal and Unitary Transforms-1-Dimensional DFT-2-Dimensional DFT- Cosine Transform- The Sine Transform- The Hadamard Transform- The Haar Transform- The Slant Transform –The KL Transform- The Singular Value Decomposition Transform.

Unit II: Image Enhancement

Basic Gray level Transformations-Image Negatives,Log transformations, Power-law Transformations,Piecewise-Linear Transformation Functions- Histogram Processing-Histogram equalization, Histogram matching, local Enhancement,Use of Histogram Statistics for Image Enhancement-Enhancement using Arithmetic/Logic Operations-Image Subtraction,Image Averaging.

Unit III : Image segmentation

Edge linking and boundary detection, Thresholding- Global and Adaptive, Region based segmentation, Segmentation by morphological watersheds, color segmentation.

Colour Image Processing

Colour Fundamentals- Colour Models- Pseudocolour Image Processing- Basics of Full-Colour Image Processing – Colour Transformations- Smoothing and Sharpening – Colour Segmentation – Noise in Colour Images – Colour Image Compression

Unit VI: Morphological operations

Dilation and erosion, Opening and closing, Hit or Miss transforms, Morphological algorithms, Extensions to gray scales images and its applications.Image compression: Compression models, Error free coding, lossy coding, compression standards, color image compression, Introduction to fractals.

Image Representation and Description

Representation-Chain codes,Polygonal Approximations, Signatures, Boundary Segments, Skeletons-Boundary Descriptors- simple descriptors, shape numbers, Fourier Descriptors, statistical moments-Regional Descriptors-simple descriptors, topological descriptors, texture, moments of two-dimensional functions.

Unit V: Image Degradation/Restoration

Unconstrained and Constrained Restoration- Restoration in the presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Estimating the degradation Function-Estimation by Image Observation, Estimation by Experimentation, Estimation by Modeling- Inverse Filtering- Minimum Mean Square Error (Wiener) Filtering- Constrained Least Squares Filtering – Geometric Mean Filter - Geometric Transformations-Spatial transformations,Gray-level Interpolation.

Reference Books

1. Digital Image processing – Gonzalez and woods
2. Video processing and communication – Yao Wang, Joern Ostermann and Ya-Qin Zhang, Prentice Hall
3. Digital video processing – M. Tekalp
4. Fundamentals of Digital Image Processing by Anil.K.Jain, PHI .

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(R11 EAI 2110) INSTRUMENTATION FOR ENVIRONMENTAL ANALYSIS
(ELECTIVE II)

Unit I : Electromagnetic radiation, Characteristics Interaction of e.m. radiation with matter Spectral methods of analysis absorption spectroscopy Beer's law radiation sources monochromators and filters diffraction grating ultraviolet spectrometer single beam and double beam instruments.

Unit II : Particles emitted in radioactive decay nuclear radiation detectors injection chamber Geiger Muller counter proportional counter scintillation counter – Semiconductor detectors – room temperature semiconductor detectors (CZT type).
Measurement techniques for water quality parameters conductivity temperature turbidity.

Unit III : Measurement techniques for chemical pollutants chloride sulphides nitrates and nitrites phosphates Fluoride phenolic compounds.

Measurement techniques for particulate matter in air. Measurement of oxides of sulphur, oxides of nitrogen unburnt hydrocarbons, carbonmonoxide, dust mist and fog.

Unit IV : General introduction to pollution and its classification. Air pollution: its effect on environment, its classification, meteorological factors responsible for pollution, method of sampling and measurement.

Air pollution control methods and equipment: basics of fluid properties, cleaning of gaseous effluents, particulate emission equipments and control, particulate collector selection and gaseous emission control. Specific gaseous pollutants analysis and control.

Unit V :
Noise pollution – measurement of sound, tollarable levels of sound. Measurement of sound level.
Measurement techniques for soil pollution.
Water pollution: its sources and classification, wastewater sampling and analysis, wastewater treatment.

Text books:
1. H.H. Willard, Merrit and Dean, "Instrumental Methods of Analysis", 5th Edn., 1974.
2. R.K. Jain, "Fundamentals of Mechanical and Industrial Instrumentation", 1985.

References:
1. S.P. Mahajan, "Pollution Control in Process Industries", Tata McGraw Hill, 1985.
2. G. N. Pandey and G.C. Carney, "Environmental Engineering", Tata McGrawHill, 1989.

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LAB – I

(R11 EAI 2201) INSTRUMENTATION LABORATORY

(Minimum of 12 experiments should be conducted)

1. Measurement of strain using strain gauge
2. LVDT – characteristics
3. Piezoelectric transducers
4. Accelerometers
5. Stroboscope – measurement of RPM & Gyroscope – measurement of Torque
6. Measurement of Density and Viscosity of Fluid
7. Flow measurement of liquid using Ultrasonic Doppler effect
8. PID pressure controller
9. Multi loop control systems – Ratio control
10. Multi loop control systems – Cascade Control
11. pH meter
12. Flame Photometer
13. Chromatography
14. UV-VIS Spectrophotometer
15. FTIR spectrophotometer

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(R11 EAI 2111) DATA ACQUISITION SYSTEM

Unit-I : Data Loggers and Data Acquisition Systems: Data acquisition systems-configurations components, analog multiplexes and sample and hold circuits-specifications and design considerations.
DACs: specifications – characteristics, types of DACs (serial, parallel, direct and indirect). Hybrid and monolithic DACs.
ADCs: specifications – characteristics, types of ADCs (serial, parallel, direct and indirect). Hybrid and monolithic ADCs,. sigma – delta ADCs', Hybrid DAS – Schematic diagram – configurations – specifications

Unit-II:.
Error Budget of DACs and ADCs: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS. Case study of a DAC and an ADC.

Data Acquisition Hardware and Software: Specifications of Hardware-IO analog signal range, gain for analog input and resolution in ADC converter, resolute\ion in DAC and counter chips, sampling frequency and maximum update rates, triggering capacity. Digital lines and ports, data acquisition VIs.

Unit-III
Distributed and stand alone data loggers: Introduction, methods of operation-programming and logging data using PCMCIA cards, standard alone operation-direct and remote connection to the host PC, stand alone logger/controller hardware interface – RS232C, RS485 standard, communication bottlenecks and system performance, using Ethernet to connect data loggers.

Unit-IV:
IEEE 488 standard: Introduction, characteristics, physical connection configurations, device types, bus structure, GPIB hand shake, device communication, IEEE 488.2, standard commands for programmable instruments.
Display systems- CRT displays, LCD Flat panel displays, Digital storage CROs, Plasma displays, Projection systems.

Unit-V:
Recorders- Basic recording system, general considerations for electronic amplifiers used for recording. Direct strip-chart recording. Servo type recorders, Potentiometric (or null), X-T and X-Y recorders, Digital memory waveform recorders.
Text Books:

1. Users Handbook of D/A & A/D Converters, E.R. HNATEK
2. Electronic Analog/Digital converters, H.Schmid
3. Data Converters, G.B. Clayton
4. Electronic Measurements, Oliver and Cage (ISE), Mc. Graw Hill
5. Transducers and Display systems, B.S. Sonde, Tata Mc. Graw Hill

References:

1. Electronic Instrumentation (ISTE Learning Material) (Ch:7) H.S. Kalsi, Learning Material Center, Indian Society of Technical Education, New Mehrauli Road, New Delhi – 110 016
2. Electronic Instrumentation & Measurements, David A.BELL
3. Hand book of Biomedical Instrumentation, Khandapur R.S., Tata Mc. Graw Hill, 1996.

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(R11PES2118) RELIABILITY ENGINEERING

Unit I:

Rules for combining probabilities of events, Definition of Reliability. Significance of the terms Appearing in the definition. Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, Binominal distribution, Poisson distribution, normal distribution, weibull distribution.

Unit II:

Hazard rate, derivation of the reliability function in terms of the hazard rate. Failures: Causes of failures, types of failures (early failures, chance failures and wear-out failures). Bath tub curve. Preventive and corrective maintenance. Modes of failure. Measures of reliability: mean time to failure and mean time between failures.

Unit III:

Classification of engineering systems: series, parallel and series-parallel systems- Expressions for the reliability of the basic configurations.

Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cutsets from Event tree.

Unit IV:

Discrete Markov Chains: General modelling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model. Absorbing states.

Continuous Markov Processes: Modelling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating time dependent and limiting state Probabilities of one component repairable model. Evaluation of Limiting state probabilities of two component repairable model.

UNIT-V:

Approximate system Reliability analysis of Series systems, parallel systems with two and more than two components, Network reduction techniques. Minimal cutest/failure mode approach.

TEXT BOOKS:

1. " Reliability evaluation of Engineering systems", Roy Billinton and Ronald N Allan, BS Publications.
2. "Reliability Engineering", Elsayed A. Elsayed, Prentice Hall Publications.

REFERENCE BOOKS:

1. "Reliability Engineering: Theory and Practice", By Alessandro Birolini, Springer Publications.
2. "An Introduction to Reliability and Maintainability Engineering", Charles Ebeling, TMH Publications.
3. "Reliability Engineering", E. Balaguruswamy, TMH Publications.

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(R11 EAI 2112) MICROCONTROLLERS AND PC BASED INSTRUMENTATION

Unit I: 8051 Core Microcontroller
8051 Core Microcontroller: Introduction-Memory Organization Logical Separation of Program memory and Data memory-Program Memory-Data Memory-Instruction Set-CPU Timing-Interrupt structure**.**

Unit II: PIC Microcontroller
PIC 16F877 Microcontroller: Introduction –Architecture-Pin Out diagram –Memory organization-ALU-Status Register-Option Register –INTCON Register-Program Counter –Watch Dog Timer –Sleep Ports Interrupt-Timer-Instruction set.

Unit –III :
Introduction to Computers
Personal Computer, Operating System, I/O Ports, Plug-in-slots, PCI bus, Operators Interface. Computer Interfacing for Data Acquisition and Control – Interfacing Input Signals, Output system with continuous actuators.
Bus Standards in PC
Introduction to PC buses – Local buses, ISA, PCI, RS 232C, RS 422, RS 485, Instrumentation buses-Mod bus – GPIB,Network buses : Ethernet – TCP / IP protocols, Outline and features of PC based instruments – Virtual Instruments.

Unit –VI: PC Programming considerations & Software aspects
PC Programming Considerations Using the command line interface; Assembly language programming; C and C++ programming; Data transfer; Scaling and linearization;
Real time languages – Programming real time systems - Discrete PID algorithms -Real time operating systems - Case studies in instrumentation.

Unit –V :
Applications in Measurement and Control
PC based data - Acquisition systems - Industrial process measurements, like flow temperature, pressure, and level - PC based instruments development system.

Text Books:
1. The 8051 Microcontroller and Embedded systems, M.A. Mazadi & J.G. Mazidi, Pearson Education.
2. PC Based Instrumentation and Control Third Edition by Mike Tooley ; Elsevier
3. PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation and Control. By Kevin James; Elsevier.

References :
1. 8051 Micro controller, Architecture, Programming – Ayala
2. Micro Controller Architecture – Kenneth Hint & Daniel Tabak
3. IBM PC and Clones - Govind Rajulu.
4. Inside the PC - Peter & Norton.
5. Ahson, S.I., “Microprocessors with applications in process control”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1984.
6. George Barney C., “Intelligent Instrumentation”, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
7. Krishna Khan, “Computer based industrial control”, Prentice Hall, 1997.

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(R11 EAI 2113) VIRTUAL INSTRUMENTATION

Unit-I :Virtual Instrumentation

Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

Unit-II : VI programming techniques

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

Unit-III : VI Chassis requirements. Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. VISA and IVI.

Application of Virtual Instrumentation: Instrument Control, Signal Measurement and generation: Data Acquisition

Unit IV

Advanced LabVIEW Data Concepts: Advanced file I/O, Configuring INI files, Calling code from other languages, Fitting Square Pegs into round holes:Advanced.

Connectivity in LabVIEW: LabVIEW web server,E-mailing data from LabVIEW,Remote Panels,Self describing data,shared variables,talking to other programs and objects,talking to other computers,database,report generation.

Unit-V

Simulation of systems using VI, Development of Control system, Industrial Communication,Image acquisition and processing, Motion control.

Text Books:

1. Gary Johnson, LabVIEW Graphical Programming, 2nd edition,McGraw Hill,Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

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(R11 EAI 2114) POWER PLANT INSTRUMENTATION
(ELECTIVE - III)

Unit I: An overview of Power Generation

Brief survey of methods of power generation – Hydro, Thermal, Nuclear, Solar, Biomass, Geo-thermal, Wind - An outline of boilers – Feed water systems – Steam circuits – combustion process – Products of combustion process – Fuel systems – Treatment of flue gases – steam turbine – condensate systems – Alternators – feed water conditioning – Turbine bypass valves.

Unit II : Parameters and their mesurement

Current Testing Equipment – Arnold Current Transformer test Bridge, Petch Elliott Current Transformer Test Bridge, Voltage Testing Equipment – Arnold Bridge Modification, Petch Elliot Bridge Modification, Power factor Measurement and Compensation, Capasitive Compensation for Power Factor Control, Generator Frequency Measurement. None electrical parameters – flow of feed water, fuel, air and steam with correction factors for temperature – pressure – temperature – smoke density measurements – dust monitors

Unit III: Control loops and Interlocks in Boiler

Combustion control – Control of main header pressure, air-fuel ratio control – furnace draft and excessive air control, drum level (three element) control, main and reheat steam temperature control - burner tilting up, bypass damper, super heater, spray and gas re-circulation control – B.F.P re-circulation control – hot well and De-aerator level control – Pulverizer control – computers in power plant.

Unit IV: Turbine Monitoring and Control

Turbine supervising system; pedestal vibration, shaft-vibration, eccentricity vibration. Installation of non-contact transducers for speed measurement, rotor and casing movement, Expansion measurement.

Unit V: Analyzers in Power Plant-I

Thermal conductivity type – Paramagnetic type Oxygen analyzer – Infrared type and trim analyzer – Spectrum analyzer – Hydrogen purity meter- Chromatography – pH meter – conductive cell – fuel analyzer – brief survey of pollution monitoring and control equipment.

Text Books:

1. Modern Power Station Practice, Vol.6, British Electricity International Pergamon Press, London ,1992
2. Boiler Control Systems, David Lindlsey, McGraw Hill Book Company,1997
3. Power Station Instrumentation , Jervice M.J., Butterwortth Heinemann,1933
4. Standard Boiler Operations (Q & A), by Elonka S.M and Kohal A.L., Tata McGraw Hill.
5. Power Plant Technology – by Wakil M.M, McGraw Hill

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(R11 EAI 2115) ROBOTICS DESIGN AND CONTROL
(ELECTIVE - III)

Unit-I: Robot Fundamentals

Definitions, History of robots, present and future trends in robotics, Robot classifications, Robot configurations, Point to Point robots, Continuous Path robots, Work volume, Issues in design and controlling robots Repeatability, Control resolution, spatial resolution, Precision, Accuracy, Robot configurations, Point to Point robots, Continuous Path robots, Work volume, Applications of robots. Drives used in robots- Hydraulic, Pneumatic and Electric drives, Comparison of drive systems and their relative merits and demerits.

Unit-II: Manipulator Kinematics

Matrix Algebra, Inverse of matrices, rotational groups, matrix representations of coordinate transformation, transformation about reference frame and moving frame Forward & Inverse Kinematics examples of 2R, 3R & 3P manipulators, Specifying position and orientation of rigid bodies Euler's angle and fixed rotation for specifying position and orientation Homogeneous coordinate transformation and examples D-H representation of kinematics linkages Forward kinematics of 6R manipulators using D-H representations Inverse kinematics of 6R manipulators using D-H representations, Inverse Kinematics geometric and algebraic methods.

Robotics Dynamics

Velocity Kinematics, Acceleration of rigid body, mass distribution Newton's equation,Euler's equation, Iterative Newton –Euler's dynamic formulation, closed dynamic, Lagrangian formulation of manipulator dynamics, dynamic simulation, computational consideration.

Unit-III: Trajectory Planning

Introduction, general considerations in path description and generation, joint space schemes, Cartesian space schemes, path generation in runtime, planning path using dynamic model point to point and continuous trajectory, 4-3-4 & trapezioidal velocity strategy for robots.

Unit IV : Robot Sensors

Internal and external sensors, position- potentiometric, optical sensors ,encoders - absolute, incremental ,touch and slip sensors velocity and acceleration sensors, proximity sensors,force & torque sensors, laser range finder, camera. Micro-controllers, DSP, centralized controllers, real time operating systems.

Unit V : Robot Controllers

Essential components-Drive for Hydraulic and Pneumatic actuators, H-bridge drives for Dc motor Overload over current and stall detection methods, example of a micro-controller/ microprocessor based robot Controller. Micro-robotics and MEMS (Microelecto mechanical systems), fabrication technology for Micro-robotics, stability issue in legged robots, under-actuated manipulators.

Robot Vision : Introduction, Image acquisition, Illumination Techniques, Image conversion, Cameras, sensors, Camera and system interface, Frame buffers and Grabbers, Image processing, low level & high level machine vision systems.

Text Books

1) S.R.Deb, " Robotics Technology and Flexible Automation ", Tata Mc Graw Hill 1994.
2) M.P.Groover, M. Weiss R.N. Nagel, N.G. Odrey " Industrial Robotics (Technology ,Programming and application s) , McGraw, Hill 1996.

3) K.S.Fu, R.C.Gonzalez and C.S.G.Lee," Robotics : Control , sensors , vision and inintlligence ",MCGraw-Hill.1987.
4) J.J.Craig , introduction to Robotics , Addision-wesely 1989.
5) Klafter , Richard D., et al " Robotics Engineering",Phl,1996.
6) Zuech,Nello,"Applying Machine Vision ",john Wiley and sons, 1988.

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(R11 EAI 2116) MICROELECTRO-MECHANICAL SYSTEMS
(ELECTIVE-III)

UNIT-I
Introduction, emergence, devices and application, scaling issues, materials for MEMS, Thin film deposition, lithography and etching.

UNIT-II
Bulk micro machining*:* Introduction, etch-stop techniques, dry etching, buried oxide process, silicon fusion bonding, and anodic bonding.

UNIT-III
Surface micro machining*:* Introduction, sacrificial layer technology, material systems in sacrificial layer technology, plasma etching, combined IC technology and anisotropic wet etching.

UNIT-IV
Microstereolithography: Introduction, Scanning Method, Projection Method, Applications. LIGA Process: Introduction, Basic Process and Application

UNIT-V
MEMS devices, electronic interfaces, design, simulation and layout of MEMS devices using CAD tools.

TEXT BOOKS:
1. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.
2. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.

REFERENCES:
1. Massood Tabib-Azar, Microactuators - Electrical, Magnetic, Thermal, Optical, Mechanical, Chemical and Smart structures, Kluwer Academic Publishers, New York, 1997.
2. Eric Udd , Fiber Optic Smart Structures , John Wiley & Sons, New York, 1995
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(R11 EAI 2117) INTELLEGENT INSTRUMENTATION
(ELECTIVE-IV)

Unit - I: Distributed Control Systems:

Evolution, Different architectures-Local control unit operator interface display, engineering interface, study of DCS, Factors effecting the selection of DCS Case studies in DCS.

Unit - II:HART And Field Bus:

Introduction –Evolution of signal standard –HART Communication Protocol – Communication Modes – HART (Highway Addressable Remote Transducers) modes-Control system interface HART commands – HART Field Controller – Field Bus Architecture Basic requirement of field bus standard field bus topology

Unit - III :PLC

Evolution of PLC's-Sequential and programmable Controllers-Architecture –Programming of PLC-Relay Logic ,Ladder Logic, Functional Blocks requirement of Communication
Networks for PLC – Connecting PLC to Computer. Use of PC as PLC- Comparative study of
Industrial PLC's –Case studies

Unit - IV: SCADA

Basic building blocks of computer control system – SCADA – MTU and RTU, Case studies On SCADA

Unit - V: Smart Instruments:

Smart/intelligent Transducer-Comparison with conventional transducers - Self diagnosis and
Remote calibration features – Smart transmitter with HART communicator- Measurement of strain, flow and pH with smart transmitters.

Text Books :

1. Distributed Control System, Lucas, Van Nastrand Reinhold Company New York
2. Programmable Controllers ; Petrezeulla
3. Programmable Controllers ; Hughes
4.HART Application Guide, HART Communication Foundation, Romily Bowden
5.Smart Transducers, Chapman, ISA press

References:

www.insrumentationguide.com
www.fieldbus.org
www.isa.org
www.plc.net

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(R11 PES 2114) NEURAL AND FUZZY SYSTEMS

Unit – I: Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrateand- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit- II: Essentials of Artificial Neural Networks

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit- III: Multilayer Feed forward Neural Networks

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and
Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

Unit IV: Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART)

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

Classical and Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT V: Fuzzy Logic System Components

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Applications

Neural network applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by | Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

Reference Books:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education.
2. Neural Networks – James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks – Simon Hykins , Pearson Education
4. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications

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(R11 EAI 2118) INSTRUMENTATION AND CONTROL IN PAPER AND PULP INDUSTRIES (ELECTIVE IV)

Unit I An Overview Of Paper Making Process

Paper making process — Raw materials — Pulp separation — screening — Bleaching — Cooking — Chemical reaction — chippers — types of digesters — H factor and Kappa factors- Stock preparation — Instrumentation needs — Energy conservation and paper quality control.

Unit II Paper Properties and Its Measurement

Physical, electrical, optical and chemical properties of paper — Basic weight, thickness, density, porosity, smoothness, softness, hardness and compressibility — stress-strain relationship — Tensile strength, bursting strength, tearing resistance, folding endurance, stiffness and impact strength — Dielectric constant, dielectric strength, dielectric loss and Properties of electrical insulating paper — Brightness, colour, gloss and capacity — Starch constant acidity and pH - Measurement techniques.

Unit III Consistency Measurement Definition of consistency — Techniques for head box consistency measurement — Stock consistency measurement and control.

Paper Making Machine Functioning of Paper making machine — Quality parameters — moisture, basic weight, caliper, brightness, colour, ash content, strength, gloss and tensile strength - parameters monitoring Instrumentation.

Unit IV Wet End Instrumentation

Conventional measurements at wet end - pressure – vacuum –temperature - liquid density - specific gravity – level – flow -consistency measurement - pH - ORP measurement – freeness measurement

Dry End Instrumentation Conventional measurements – moisture - basis weight – caliper -coat thickness - optical variables - measurement of length – speed –Digester - Rotary - Batch type

Unit V

Pumps and Control Valves

Flow box - wet end variables - evaporator feedback - feed forward control - lime mud density control - stock proportioning system -refiner control instrumentation - basic pulper instrumentation -headbox - rush/drag control - instrumentation for size preparation -coating preparation - coating weight control - batch digester - k/kappa number control - bleach plant chlorine stage control

Control Aspects Machine and cross direction control technique — consistency, moisture and basic weight control — dryer control — computer based control systems - mill wide control.

Text books

1. Sankaranarayanan, P.E., Pulp and Paper Industries — Technology and Instrumentation Kotharis Desk book series, 1995.

2. Handbook of Pulp and Paper technology, Britt K.W.Van Nostrand Reinbold Company, 1970.
3. James P.Casey , Pulp and Paper chemistry and chemical Technology, John Wiley and sons, 1981.
4. Austin G.T., Shrencs Chemical Process Industries, McGraw Hill International Student Edition, Singapore, 1985.

References

1. John R Lavigne, An Introduction to Paper Industry Instrumentation, Miller Freeman Publications, California, 1985 Series
2. Robert J. McGill, Measurement and Control in Papermaking,Adam Hilger Limited, Bristol, 1980
3. John R. Lavigne, Instrumentation Applications for the Pulp and Paper Industry, Miller Freeman Publications, California, 1990
4. Liptak, B. G., Instrument Engineers Handbook, volume 2,Process Control, Third edition, CRC press, London, 1995

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LAB – II (R11 EAI 2202) VIRTUAL INSTRUMENTATION LABORATORY

30 Experiments have to be completed

List of experiments

1. Design of Decimal Counter Using Lab VIEW
2. Design of A function generator using Lab VIEW
3. Design of Filters Using NIELVIS.
4. Signal processing with speed 33 (speech recording and analysis)
5. Image Processing techniques with Vision Assistant
6. Image Processing application with vision assistant.
7. Image corrupted with salt and pepper noise ,apply average local 3 X 3 filter, local average 5 X 5,local average 7 X 7 and median filter observe the response using Vision Assistant

Control design simulation using LabVIEW

1. Building and Configuring Simulations (Control Design and Simulation Module)
2. Modularizing the Simulation Diagram (Control Design and Simulation Module)
3. Trimming and Linearizing Nonlinear Models
4. Executing Simulations in Real Time
5. Optimizing Design Parameters
6. Simulation Model Converter

Networking using LabVIEW

1. Creating a TCP Client
2. Creating a TCP Server
3. Binding Front Panel Controls to Shared Variables
4. Binding Front Panel Controls to Shared Variables in Other Projects
5. Binding Shared Variables to an Existing Source
6. Changing the Default Ports for TCP-Based NI-PSP
7. Configuring Firewalls and Network Address Translating Routers for Shared Variables

calling Code Written in Text-Based Programming Languages

1. Building a Shared Library to Call from LabVIEW
2. Building a Function Prototype
3. Completing the .c File
4. Setting Input and Output Terminals for the CIN
5. Wiring Inputs and Outputs to the CIN
6. Creating a .c File
7. Compiling the CIN Source Code
8. Loading the CIN Object Code

Managing Performance and Memory

1. Profiling VI Execution Time and Memory Usage
2. Extending Virtual Memory Usage for 32-bit Windows

Signal Processing Using LabVIEW

1. Characteristics of an Ideal Filter
2. FIR Filters
3. IIR Filters
4. Comparing FIR and IIR Filters
5. Nonlinear Filters
6. Selecting a Digital Filter Design
7. FFT Analysis using LabVIEW
8. Design of digital filter using LabVIEW