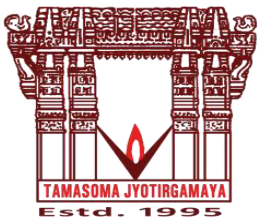
ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M. Tech.
ELECTRONICS AND INSTRUMENTATION

(Applicable for the batches admitted from 2015-2016)



VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institute, Accredited by NAAC with 'A' Grade
NBA Accreditation for CE, EEE, ME, ECE, CSE, EIE, IT B.Tech. Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH
Recognized as "College with Potential for Excellence" by UGC
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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD
An Autonomous Institute

Academic Regulations - M.Tech. Programme
(Applicable for the batches admitted from the academic year 2015-2016)

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 2015-16, for the students admitted into two year post graduate programme offered by the college leading to Master of Technology (M. Tech.) degree in different specializations offered by the departments of Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer Science and Engineering, Information Technology and Electronics and Instrumentation Engineering.

The M.Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on students who are admitted to the programme 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 and qualifications prescribed from time to time. Admissions shall be made on the basis of GATE Rank and merit rank obtained at an Entrance Test conducted by the TSSCHE or as decided by TSSCHE subject to reservations prescribed by the university/ State Government from time to time.

2. Programmes of study

The following two year M.Tech. degree programmes of study are offered by the departments at VNR VJIET.

Department	Specializations
ME	1. Advanced Manufacturing Systems 2. Automation 3. CAD/CAM
CE	1. Highway Engineering 2. Structural Engineering 3 Geotechnical Engineering
EEE	1. Power Electronics 2. Power Systems
CSE	1. Software Engineering 2. Computer Science & Engineering
ECE	1. VLSI System Design 2. Embedded Systems
EIE	Electronics and Instrumentation
IT	Computer Networks and Information Security

- **'ENGLISH'** language is used as the medium of instruction in all the above programmes.

3. Attendance requirements

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

3.1 A student shall be eligible to appear for the semester end examinations in subject if he / she acquire a **minimum of 75% of attendance in that subject.**

3.2 Shortage of attendance up to 10% in any subject (i.e., attendance of 65% and above and below 75%) in a semester may be condoned by the Institute Academic Committee based on the rules prescribed by the Academic Council of the Institute from time to time.

3.3 A student shall get **minimum required attendance in at least three (03) 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 student 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 student secures less than the required attendance in any subject(s), he shall not be permitted to appear for the semester end examination in that subject(s). He shall re-register for the subject when offered next.

4. Evaluation

i. The performance of a student in each semester shall be evaluated subject–wise with a maximum of **100 marks for theory** and **100 marks for practical subjects**. In addition, **mini-project** and **comprehensive viva-voce** shall be evaluated for **100 marks** respectively.

ii. For theory subjects, the distribution shall be **40 marks for mid-term evaluation** and **60 marks for the semester end examination**.

❖ **Mid-Term Evaluation (40 M):**

Mid-term evaluation consists of **mid-term examination (30 M)** and **assignment/objective test/ case study/course project (10 M).**

➢ **Mid-term examination (30 M):**

- For theory subjects, two mid-term examinations shall be conducted in each semester as per the academic calendar. Each mid-term examination shall be evaluated for 30 marks.
- Pattern of Mid-term examination:
  3 X 10M = 30 M (three internal choice questions one from each UNIT shall be given, the student has to answer ONE question from each UNIT)
- There shall be TWO mid-term examinations for each subject and the average of two mid-term examinations shall be considered for calculating final mid-term examination marks in that subject.

➢ **Assignment/objective exam/ case study/course project (10 M):**

- Two assignment/objective exam/ case study/course project shall be given to the students covering the syllabus of first mid-term and second mid-term examinations respectively and evaluated for 10 marks each.
- The first assignment/objective exam/ case study/course project shall be submitted before first mid-term examination and the second one shall be submitted before second mid-term examination.
- The average of 2 assignments shall be taken as final assignment marks.

iii. For practical subjects, there shall be a **continuous evaluation during the semester for 40 marks and 60 marks for semester end examination**. Out of the 40 marks, **day-to-day work in the laboratory shall be evaluated for 10 marks**, and **15 marks for practical examination** and **15 marks for laboratory record.**

❖ **Semester End Examination (60 M):**

(a) Theory Courses

Question paper pattern for semester end examination (60 Marks)

- Paper shall consist of 05 questions of 10 marks each. (05X12M = 60 M)
- There shall be 01 question from each unit with internal choice.

(b) Practical Courses

Each laboratory course shall be evaluated for 60 marks. The semester end examination shall be conducted by two examiners, one Internal and other external concerned with the subject of the same / other department / Industry. The evaluation shall be as per the standard format.

4.1. Evaluation of Mini-Project: There shall be two presentations during the first year, one in each semester. For mini-project 1 and mini-project 2, a student under the supervision of a faculty member, shall collect the literature on a topic, critically review the literature, carry out the mini-project, submit it to the department in a report form and shall make an oral presentation before the departmental Project Review Committee (PRC). The Departmental PRC consists of Head of the Department, supervisor and one senior faculty member of the department. For each mini-project there shall be only internal evaluation of 100 marks. A student has to secure a minimum of 50% to be declared successful.

4.2. There shall be a comprehensive viva-voce in II year I semester. The comprehensive viva- Voce shall 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. programme of study. The comprehensive viva-voce shall be evaluated for 100 marks by the committee. There are no internal marks for the comprehensive viva-voce. A student must secure a minimum of 50% to be declared successful.

4.3. A student shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the semester end examination and a minimum aggregate of 50% of the total marks in the semester end examination and mid-term evaluation taken together.

4.4. A student shall be given one chance to re-register, after completion of the course work, for each subject, provided the internal marks secured by a student are less than 50% and he has failed in the semester end examination. In such a case student 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 where the internal marks are less than 50% with prior permission.

4.5. 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 a teacher from the same department other than the teacher who conducted laboratory classes for that batch.

5. Evaluation of Project / Dissertation Work.

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

1 A Project Review Committee (PRC) shall be constituted with at least four members namely HOD, PG coordinator of the M.Tech. programme, project supervisor and one senior faculty member of same specialization.

5.3 After getting permission as per 5.1, a student has to submit, in consultation with the project supervisor, the title, objective and plan of action of his project work to the Departmental PRC for its approval. Only after obtaining the approval of PRC, the student can initiate the project work.

5.4 If a student wishes to change his supervisor or topic of the project he can do so with the approval of PRC. However, the committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, the date of registration for the project work shall be 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 second year by the PRC. A student shall submit draft 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 student is permitted to submit Project work 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 student shall submit the draft copy of thesis to the Head of the Department (Through project supervisor and PG coordinator) and shall make an oral presentation before the PRC.
The student is eligible to submit project work if he has published at least one paper covering 70% of the project work and presented his project work in Show and Tell activity.

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

5.8 The dissertation 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 student shall revise and resubmit the Dissertation, within the time frame as prescribed by PRC. If the report of the examiner is unfavourable again, the dissertation 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 project supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The Board shall jointly report students 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 student has to secure any one of the grades as Excellent, Good or Satisfactory on his dissertation and viva-voce. If the report of the viva-voce is unsatisfactory, the student shall retake the

viva-voce examination after three months, making modifications as suggested. If he fails to get a satisfactory report at the second viva-voce examination, he has to re-register for the project work as mentioned in clause 5.1. However, the student may select a new guide or new topic or both with the approval of the PRC and submit the project dissertation with a minimum of 240 days from the date of re-registration. Of course, this shall not prejudice the clause 6.1 below.

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 complete 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 A student shall register and put up **minimum academic requirement in all 84 credits** and earn **84 credits.** Marks obtained in all 86 credits shall be considered for the calculation of Cumulative Grade Point Average (CGPA).

6.3 CGPA System:

Method of awarding absolute grades and grade points in two year M.Tech. degree programme is as follows:

- Absolute Grading Method is followed, based on the total marks obtained in mid-term evaluation and semester end examinations.
- Grades and Grade points are assigned as given below.

Marks Obtained	Grade	Description of Grade	Grade Points(GP) Value Per Credit
>=90	O	Outstanding	10.00
>=80 and <89.99	A	Excellent	9.00
>=70 and <79.99	B	Very Good	8.00
>=60 and <69.99	C	Good	7.00
>=50 and <59.99	D	Pass	6.00
<50	F	Fail	
Not Appeared the Exam(s)	N	Absent	

The student is eligible for the award of the M.Tech degree with the class as mentioned in the following table.

CGPA	Class
>= 8.0	First Class with Distinction
>= 7.0 and <8.0	First Class
>= 6.0 and < 7.0	Second Class

- **Calculation of Semester Grade Points Average (SGPA):**

- The performance of each student at the end of the each semester shall be indicated in terms of SGPA. The SGPA shall be calculated as below:

$$\text{SGPA} = \frac{\text{Total earned weighted grade points in a semester}}{\text{Total credits in a semester}}$$

$$\mathbf{SGPA} = \frac{\sum_{i=1}^{p} \mathbf{C_i} * \mathbf{G_i}}{\sum_{i=1}^{p} \mathbf{C_i}}$$

Where Ci = Number of credits allotted to a particular subject 'i'

Gi = Grade point corresponding to the letter grade awarded to the subject 'i'

i = 1,2,…..p represent the number of subjects in a particular semester

Note: SGPA is calculated and awarded for the students who pass all the courses in a semester.

- **Calculation of Cumulative Grade Point Average (CGPA):**

The CGPA of a student for the entire programme shall be calculated as given below:

- Assessment of the overall performance of a student shall be obtained by calculating Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained in all subjects during the course of study.

$$\mathbf{CGPA} = \frac{\textbf{Total earned weighted grade points for the entire programme}}{\textbf{Total credits for the entire programme}}$$

$$\mathbf{CGPA} = \frac{\sum_{j=1}^{m} \mathbf{C_j} * \mathbf{G_j}}{\sum_{j=1}^{m} \mathbf{C_j}}$$

Where Cj = Number of credits allotted to a particular subject 'j'

Gj = Grade Point corresponding to the letter grade awarded to that subject 'j'

j = 1,2,….m represent the number of subjects of the entire program.

- Grade lower than D in any subject shall not be considered for CGPA calculation. The CGPA shall be awarded only when the student acquires the required number of credits prescribed for the program.

- **Grade Card**

The grade card issued shall contain the following:

a) The credits for each subject offered in that semester

b) The letter grade and grade point awarded in each subject

c) The SGPA/CGPA

d) Total number of credits earned by the student up to the end of that semester.

7. Withholding of Results

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

8. Transitory Regulations

Students who have discontinued or have been detained for want of attendance or any other academic requirements, may be considered for readmission as and when they become eligible. They have to take up Equivalent subjects, as substitute subjects in place of repeated subjects as decided by the Chairman

of the BoS of the respective departments. He/She shall be admitted under the regulation of the batch in which he/she is readmitted.

9. Minimum Instruction Days

The minimum instruction days for each semester shall be **90 instruction days.**

10. General

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

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

10.3 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.

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

11. Supplementary Examination

Supplementary examinations shall be conducted along with regular semester end examinations. (During even semester regular examinations, supplementary examinations of odd Semester and during odd semester regular examinations, supplementary examinations of even semester shall be conducted).

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

M.TECH. (ELECTRONICS & INSTRUMENTATION)
(R15 Regulation)

I Year I Semester **COURSE STRUCTURE**

Code	Group	Subject	L	T/P/D	Credits
EAI 001	Core	Transducers and Applications	3	1	4
EAI 002		Signal Conditioning Circuits	3	1	4
EAI 003		Process Control Instrumentation	3	1	4
EAI11	Elective – I & Elective – II Basket	Analytical Instrumentation	3	0	3 + 3
EAI12		Advanced Control systems	3	0	
EAI13		Fibre Optic and Laser Based Instrumentation	3	0	
EAI14		Instrumentation practices in Industries.	3	0	
EAI15		Instrumentation for Environmental Analysis	3	0	
EAI16		Principles and Applications of Nano-sciences	3	0	
EAI31	Open Elective –I	Biomedical Instrumentation	3	0	3
EAI32		Real Time and Embedded Systems	3	0	
EAI33		Digital Image processing	3	0	
EAI51	Lab	Instrumentation Laboratory	0	3	2
EAI61		Mini Project -1	0	0	4
Total			**18**	**6**	**27**

I Year II Semester **COURSE STRUCTURE**

Code	Group	Subject	L	T/P/D	Credits
EAI04	Core	Data Acquisition System	3	1	4
EAI05		Power Plant Instrumentation	3	1	4
EAI06		Virtual Instrumentation	3	1	4
EAI21	Elective – III & Elective – IV Basket	PLC , SCADA programming and their Application	3	0	3 + 3
EAI22		Robotics Design and Control	3	0	
EAI23		Micro-Electro-Mechanical Systems	3	0	
EAI24		Pharmaceutical Instrumentation	3	0	
EAI25		Industrial electronics	3	0	
EAI26		Instrumentation and Control in Paper & Pulp Industries	3	0	
PES41	Open Elective –II	Reliability Engineering	3	0	3
EAI41		CPLD and FPGA Architectures and Applications	3	0	
EAI42		Neural Networks & Fuzzy Systems	3	0	
EAI52	Lab	Virtual Instrumentation Laboratory	0	3	2
EAI62		Mini Project -2	0	0	4
Total			**18**	**6**	**27**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

M.TECH. (ELECTRONICS & INSTRUMENTATION)
(R15 Regulation)

II Year I Semester **COURSE STRUCTURE**

Subject Code	Subject Name	L	p	Credits
EAI63	Comprehensive Viva Voce	0	0	4
EAI71	Internship/Dissertation Phase – I	0	0	8
Total				**12**

II Year II Semester **COURSE STRUCTURE**

Subject code	Subject name	L	T/P/D	Credits
EAI72	Dissertation Phase – II	0	0	18
Total				**18**

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**1**	**4**

(EAI01) - TRANSDUCERS AND APPLICATIONS

Course Objectives:

Student will be able to

- Understand Static and Dynamic Characteristics of Measuring Systems
- Learn the concepts of various measuring devices to measure physical parameters like displacement, temperature, pressure, flow.
- Learn the concepts of transducers for measuring acceleration, velocity, force, torque etc.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Identify suitable sensors and transducers for real time applications.
- Translate theoretical concepts into working models.
- Design the experimental applications to engineering modules and practices.
- Design engineering solution to the Industry/Society needs and develop products.

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: 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 and pH measurement: Ion Selective Type. Radiation Fundamentals - Radiation Detectors - Radiation Thermometers and 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 IV 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	**1**	**4**

(EAI02) - SIGNAL CONDITIONING CIRCUITS

Course Objectives:

Student will be able to

- Understand the working principle and design of various analog signal conditioning circuits used in industrial applications.
- Impart knowledge on the design of signal conditioning circuits
- Impart the knowledge of various measurement methods of physical parameters like velocity, acceleration, torque, pressure, flow, temperature etc. and their relevance to Industry.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Understand principle of working of various signal conditioners used with Temperature, Displacement, Optical and various miscellaneous other sensors.
- Design signal conditioning circuits for various transducers.
- Understand applications of various signal conditioners used in industry.
- Capable of selecting best suited signal conditioners for any given application.

UNIT I:

Interfacing, Amplifiers & Signal Translation:

Bridges: The Wheat Stone Bridge – Single Variable Element, Two Single Variable Element & Four Single Variable Element, Excitation, Readout – bridge amplifier, instrumentation Amplifier, minimize common mode voltage, Isolator, Chopper Amplifier

Interference: Local Problems, Subsystems Problems – grounding mechanisms, Outside & Local Interface – guard circuit, Analog Filtering – Design of 1st order & 2nd order filters, Operational Amplifiers, Instrumentation Amplifiers, Isolation Amplifiers, System Solutions

UNIT II:

Offsetting & Linearizing, 2 Interfacing – Design Examples: Offsetting – use of bridge in offsetting, 4 – to – 20 mA Current Transmission – typical 4 – 20 mA Transmission, isolated 4 – 20 mA Transmission, basic 0 to 10V to 4 to 20mA Translation circuit, Non Linearity & Linearizing – Digital Linearizing & Analog Linearizing
Interface Design Questions, Thermometer Example

UNIT III:

Applications – I :

Thermoswitches & Thermocouples Interfacing: Thermoswitches, Ambient Referenced Thermocouples, Isolated Thermocouple Measurement, Thermocouple to Frequency, Thermocouple to 4 – to – 20 m A Temperature Transmitter, Isolated Multiplexing of Thermocouples

RTD's Interfacing: Single Op – Amp Interface, using a Signal Conditioner, Bridge configuration using 3 – wire RTD, Linearizing RTD Circuits, Current Transmitters for RTD Outputs, RTD Based Precision controller

Thermistor Interfacing: Simple Interface Circuits, High – Resolution Differential Thermometer, Current Transmitters, Thermistor to Frequency Conversion

UNIT IV:

Applications – II :

Semiconductor Temperature Transducers Interfacing: T – to – F Conversion using Diodes, Absolute Temperature – to – current Conversion, Temperature Control Circuits, Multiplexed Applications, Isolation, 4 – to – 20 m A Current Transmission

Pressure Transducer Interfacing: Strain Gauge Based Transducers, Potentiometer to Frequency Transducer, Interfacing High level Semiconductor Transducers, Isolated Pressure Transmitter, Pressure Control System

Force Transducer Interfacing: Spring Driven Rheostat, Strain – gauge & Signal Conditioner, High Resolution Load Cell Platform Interface, Strain Gauge to Frequency Conversion, Isolators & Transmitters

UNIT V:

Applications – III:

Flow Meter Interfacing: Differential Pressure Flow meters, Frequency output Flowmeters, Anemometers, Hinged Vane Flowmeter, Thermal Flow Meter, Transmission & Readout

Level Transducers Interfacing: Float & Potentiometer, Optical Sensing & Thermal Sensing

Miscellaneous Applications: 4 – to – 20 m A Transmission, Topics on Filtering, Programmable – Gain Isolator, High – Performance Floating Data Amplifier, Isolated All – Electronic Multiplexing, Pulsed – Mode Bridge Excitation

Text Books:

1) Transducer Interfacing Handbook – A Guide to Analog Signal Conditioning, Edited by Daniel H Sheingold – Analog Devices Publications

References:

1) Op Amp Applications Handbook, Walt Jung, Editor, Elsevier
2) Palls Areny, John G.Webster, Sensors and Signal Conditioning, second edition, John Wiley and Sons, 2000
3) Robert B.Northrop, Introduction to Instrumentation and measurement-second edition-Taylor &Francis group

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**1**	**4**

(EAI03) PROCESS CONTROL INSTRUMENTATION

Course Objectives:

Student will be able to

- Understand the basic characteristics of first order and higher order processes.
- Acquire knowledge about the characteristics of various controller modes and methods of tuning of controller.
- Acquire knowledge on the construction, characteristics and application of control valves.
- Study the unit operations and a case study of distillation column control

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Determine the mathematical model for real-time first and higher order systems.
- Design various controller modes with appropriate tuning
- Implement advanced control schemes for various processes
- Enhance the performance of multi-loop and multivariable control systems

UNIT I:

Introduction: Incentives for process control, Design aspects of process control system, Process degree of freedom. Mathematical model of first order processes: level, pressure and thermal processes – Second order process: Interacting and non-interacting processes, – Time and frequency response analysis.

UNIT II:

Basic Single Loop Control Actions: Characteristics and dynamics of Discrete Control Modes: ON-OFF, Multi Speed, Floating Controllers. Characteristics and dynamics of feedback control modes: Proportional, Integral and Derivative control modes – P+I, P+D and P+I+D control modes.

UNIT III:

P-I-D Controller Tuning and Stability Analysis:

Tuning of Controllers: Evaluation criteria – IAE, ISE, ITAE, Tunings – Process reaction curve method – Ziegler Nichols method – Damped oscillation method. Design of Lead, Lag compensators, stability analysis

UNIT IV:

MIMO Systems -Multiloop Control:

MIMO Systems: Dynamics of Distillation column and Heat exchangers processes,

Multi loop Controllers: Feed-forward control – ratio control- cascade control – adaptive – split-range control – multivariable control – examples from distillation column and boiler systems.

Modern control practices in: Power plants, pharmaceuticals and petrochemicals industries.

UNIT V:

Final Control Element: I/P converter – pneumatic and electric actuators – valve positioner – control valves – characteristics of control valves – inherent and installed characteristics – control valve sizing – cavitation and flashing – selection criteria.

Text Books:

1. Stephanopoulis, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990.
2. Bela. Liptak, Process Control,
3. Curtis Johnson, Process Control Instrumentatiuon Technology, Prentice Hall India.

References:

1. Pollard A.Process Control, Heinemann educational books, London, 1971.
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993.
3. S.K.Singh, Process Control, PHI Publications, New Delhi 2010.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI11) - ANALYTICAL INSTRUMENTATION
(Elective)

Course Objectives:

Student will be able to

- Understand whole array of modern analytical instrumentation with the goal of providing them with the tools to further apply them in industry.
- Acquire “hands-on" approach with sample preparation, theory, application, method development, data analysis and interpretation being key elements.
- Qualitative and quantitative analysis of chemical compounds.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Observe basic lab safety rules while working in analytical chemistry laboratories
- Appreciate basic analytical processes and sampling procedures
- Appreciate the basic principles of spectroscopy
- Perform simple analytical procedures on given samples using Ultraviolet or Infrared Spectrophotometers and Interpret data derived from the above.

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, Raman Spectroscopy, Interpretation & Analysis.

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, Interpretation and Analysis.

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

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: Industrial analyzer circuits; CO monitors – Nox analyzer – Sox Analyzer - H2S analyzer system –

UNIT V:

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

Thermal Analyzers: Differential Scanning Calorimetry (DSC), Derivative Thermo Gravimetric Analyzers (DTGA)

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, HeltSaunder publication

References:

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

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI12) ADVANCED CONTROL SYSTEMS
(Elective)

Course Objectives:

Student will be able to

1. Acquire the knowledge of basics of digital control system for the real time analysis
2. Analyze and design the controllers for digital systems.
3. Acquire comprehensive knowledge of concepts of stability analysis and design of discrete time systems.
4. Understand the concepts of optimal control for discrete domain

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

1. Understand the concepts of Digital control systems.
2. Understand and analyze of discrete systems in state variable analysis.
3. Understand and analyze the concept of stability analysis and design of discrete time systems.
4. Understand comprehensive knowledge of optimal control.

UNIT I:

Control system design by root locus method-lead, lag and lead lag compensation. PI, PD and PID controllers design procedures and examples. Control system design by frequency response approach- lead, lag and lead lag compensation. PI, PD and PID controllers design procedures and examples.

UNIT II:

Eigen Value and Eigenvector Sensitivities in Linear System Theory: Continuous time systems: Introduction, first-order Eigen value sensitivities, first order eigenvector sensitivities, second-order Eigen value sensitivities, first order eigenvector sensitivities, second order Eigenvector sensitivities.

UNIT III:

Mode-Controllability Matrix: Distinct Eigen-values, confluent Eigen-values associated with single Jordan block, confluent Eigen-values associated with number of distinct Jordan blocks, confluent Eigen-values associated with a number of non-distinct Jordan block.

Mode –Controllability structure of multivariable linear systems: Introduction, Distinct Eigen-values, confluent Eigen-values associated with single Jordan block, confluent Eigen-values associated with a number of non-distinct Jordan blocs.

UNIT IV:

Observability Matrices: Distinct Eigen-values, confluent Eigen-values, mode observability structure of multivariable linear systems: Introduction, Distinct Eigen-values, confluent Eigenvalues. Nonlinear systems: Common physical nonlinearities: the phase plane method – basic concept, singular points, construction of phase trajectories – Isocline and delta methods, Describing function – basic concept – derivation of describing functions – stability analysis by describing function method.

UNIT V:

Lyapunov Stability Analysis: Second method of Lyapunov, stability in the sense of Lyapunov, construction of Lyapunov functions – Krasovskii's and variable gradient methods, Lyapunov stability analysis of linear time varying systems.

Text Books:

1. Advanced Control Systems B. N. Sarkar, PHI Learning Private Limited.
2. Advanced Control Theory, Somanath Majhi, Cengage Learning.
3. Control System Engineering – I J Nagarath, M. Gopal – New Age International – 3rd edition.

4. Control Systems – N K Sinha – New Age International – 3rd edition.

References:

1. Automatic Control Systems – B C Kuo – PHI – 7th edition.
2. Modern Control Systems – Hsu and Meyer.
3. Modal Control theory and applications – Brian Porter & Roger Corssley.
4. Modern Control Engineering - K. Ogata – PHI – 3rd edition.

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI13) - FIBER OPTIC AND LASER INSTRUMENTATION (Elective)

Course Objectives:

Student will be able to

- Understand the principles of optics and Lasers.
- Apply the knowledge of Optics to fibers and understand the different industrial applications of Optical Fibers.
- Learn the various applications of Lasers in Instrumentation.
- Understand the Opto electronic components and their principles of operation along with their applications.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of mathematics and Optics to design application specific optical fiber.
- Apply Lasers in Instrumentation for the measurement of Pressure, temperature, Level and find the solutions for the errors if any.
- Understand the advantages of using Lasers.
- Apply opto- electronic components and lasers in Medical instrumentation.

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.

Waveguides and Micro-Optical Fiber Bundles

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. Laser Safety: Radiation hazards, maximum permissible exposure, classification, safety measures and Personal Protective Equipment (PPE)

UNIT III:

Industrial Applications of Optical Fibers: Fiber optic sensors – Fiber optic Instrumentation system - Interferometric method of measurement of length - Moiré 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 - CO_2 laser as bloodless scalpel, Removal of tumors of vocal cords, Brain surgery, Plastic surgery, Gynecology, Oncology, Dermatology and Ophthalmology. Holography – Basic principle; methods (reflection, transmission, and hybrid), Holographic Components, Holographic Interferometry and Applications, Holography for Non-destructive Testing

UNIT V:

Opto-Electronic Components: Photodiodes, phototransistors, photomultipliers, optoisolators/optocouplers, IOC elements, photoresistors, CCD, laser diodes, LED, OLED, AMOLED; Magneto Optic and Acoustic – optic and other types of Optical Modulators – Detectors – Application in Instrumentation

Text Books:

1. 'Optical Fiber Communication – Principles and Practice', J.M. Senior, , Prentice Hall of India, 1985.
2. 'Introduction to Opto Electronics', J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.
3. Lasers: Theory and Applications – by Thyagarajan K. and Ghatak A.K., Plenum Press
4. 'Optical Fibre Communication and Sensors', M. Arumugam, Anuradha Agencies, 2002.

References:

1. Understanding Fiber Optics, 4th or 5th edition; Jeff Hecht; Prentice Hall publishers
2. 'Optical Fibre Communication', G. Keiser, 'McGraw Hill, 1995.
3. Monte Ross, 'Laser Applications', McGraw Hill, 1968

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI14) INSTRUMENTATION PRACTICES IN INDUSTRIES
(Elective)

Course Objectives:

- Identify and quantitatively estimate different materials required for the manufacturing of Cement, Pulp, Paper, food, Power and pharmacy.
- Understand the principles of different manufacturing processes.
- Recognize these principles written in form of mathematical & chemical equations.
- Apply these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical industrial problems.

Course Outcomes:

- Apply fundamental knowledge of chemistry & instrumentation to modeling and analysis of different Industrial engineering.
- Understand disasters caused by an incorrect analysis/design in different Industrial engineering system.
- Students will demonstrate a working knowledge of the basic principles of measuring techniques and demonstrate technical knowledge and skills in the calibration and use of equipment used in different industrial process measurement and control.
- Students will demonstrate a working knowledge of safety practices and skills in trouble-shooting problems used in the measurement and control in industrial processes

UNIT I:

Cement Industries: Corrosion Analyzer Porositester Compressive strength measurement, Blast Furnace Temperature Measurement using Radiation Pyrometers.

UNIT II:

Pulp and Paper Industries:

Manufacture of Pulp: Raw materials, Pulping processes, Craft pulping, Soda pulping, Sulfite pulping, Semi chemical pulping, Mechanical and Thermo mechanical Pulping.

Manufacture of Paper: Wet Processing, Fourdrinier Machine, Coated Papers, Special Papers.

Wet-end Instrumentation: Pressure: Force Balanced, Bell and Limp or Slack type systems

Temperature: Liquid in Glass, Thermal bulbs, Resistance Bulbs

Liquid Density and Specific Gravity: Fixed Volume, Differential Pressure, Nuclear Radiation

Level: Liquid Level- Continuous Purge Instrument, Diaphragm box, Float and Cable, Capacitive.
Solid Level- Diaphragm solids.

Flow: Tapered tube & float type meter, Cylinder & Piston type meter, Weir and Flumes

Consistency: Atmospheric with Driven and Atmospheric with Stationary Sensors.

pH: pH Electrode system, types of electrodes.

Oxidation Reduction Potential (ORP): ORP Electrode system, electrode holders.

Freeness: Continuous Sample and Intermittent Sample Systems.

Dry-end Instrumentation: Moisture: Conductivity, Resistance, Capacitance, Hygroscopic, Infrared Absorption type systems Basis Weight: Transmission type, On-Machine type, Off-Machine type and Backscatter type systems Caliper or Thickness: Contacting type- Electrical, Mechanical and Electro Mechanical, Non-Contacting type

UNIT III:

Petroleum Industries: Unit Operations: Distillation, Drying Separation Measurements in refineries petrochemical industries – Differential pressure transmitter, Thermocouples Infrared Pyrometer, Mass flow meters, Potentiometric level Transmitter, Vacuum Measurement, Near Infrared Analyzer, Hydro Carbon Dew point meter IR Spectrometry, Mass Spectrometry, Flame Ionization Detectors, Chromatography.

Unit IV:

Nuclear Power Plant: Introduction, The power plant scheme, Pressure, flow and level measurement, Vibration and expansion measurements, Analysis of impurities in cooling water, Flue Gas analysis, Ultrasonic Thermometry, Radiation Pyrometry, Emittance measurement.

Unit V:

Food Processing and Allied Industries: Chromatography, Spectrometry – Mass Spectrometer, Toxicity meter.

Text Books:

1. Chemical Process Industries, Austin G.T. Shreeves, McGraw-Hill International student edition, Singapore, 1985
2. Process measurement and analysis, Liptak B.G., Third edition, Chilton book Company, 1996.
3. Pulp and Paper Industry Technology & Instrumentation, Sankaranarayana, P.E., Kothari's Deskbook.
4. Principles of Industrial Instrumentation, D. Patranabis, Mc Graw Hill.

References:

1. An Introduction to Paper Industry Instrumentation, John R Lavigne, Miller Freeman Publications, Califirnia, 1985 Series.
2. Mearsurement and Control in Papermaking, Robert J. McGill, Adam Hilger Limited, Bristol, 1980.
3. Process/ industrial instruments and controls hand book, Gregory K. McMillan, Doig;as M. Considine.
4. Instrumentation in process industries, Liptak B.G., Chilton book Company, 1994.

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
Elective I	**3**	**0**	**3**

(EAI15) - INSTRUMENTATION FOR ENVIRONMENTAL ANALYSIS (Elective)

Course Objectives:

Student will be able to

- Identify the different environment affecting parameters and the relationship between them
- Understand the principles of measurement of radiation, chemical pollutants, Air pollution control methods, Noise pollution, and Water pollution
- Recognize these principles written in form of mathematical equations
- Apply these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical environmental analysis problems
- Apply fundamental principles of pollution measurements for the solution of practical environmental analysis problems of water, air, noise, radiation etc.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of mathematics to modeling and analysis of radiation, chemical pollutants, air& water pollution on environment.
- Interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Understand or become aware of environment pollution causedby an incorrect analysis in engineering system.
- Connect data and quantitatively interpret, predict anticipated projection of pollutions.

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 McGraw Hill, 1989.

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI16) PRINCIPLES AND APPLICATIONS OF NANOTECHNOLOGY (Elective)

Course Prerequisites: Engineering Physics, Engineering Chemistry, Electronic Devices & Circuits

Course Objectives:

- Throwing light on the multidisciplinary nature of nanotechnology and its applications
- Understanding various nanomaterials and methods manipulating these materials for wide variety of applications
- Providing knowledge about metrology equipment for nanoscale measurements
- Providing overview of specific applications of nanotechnology to electronics and medicine

Course Outcomes:

After the completion of the course, students will be able to:

- Evaluate the design considerations for nanoscale materials, devices, and structures in a wide variety of applications
- Gain theoretical knowledge to synthesize, manipulate, characterize, and use nanomaterials for typical applications
- Appreciate the need for specialized metrology for nanoscale measurements and familiarize with various commonly used equipment
- Identify the applications of nanotechnology to electronics with focus on the use of III-V compounds and carbon nano-tubes and Learn the advancements in the field of medicine due to the advent of nanotechnology.

UNIT I:

Introduction to Nanotechnology: Introduction & History: Overview of atomic physics; Chemistry of atoms and molecules; Overview of quantum mechanics; Feynman's perspective of nanoscience; Social impact of nanotechnology; Motivation, Top-down vs. Bottom-up approaches

Applications: Electronics, instrumentation, medicine, aerospace, and material science.

Considerations: Size constraints on measurements; Constraints of thin-film structures, constraints due to dimensions of nanostructures; Optical, Electronic, and Magnetic Properties at Nanoscale

UNIT II

Nanomaterials and Fabrication: Introduction to Nanomaterials: Metal Nanomaterials, Semiconductor nanomaterials, Quantum Dots, Quantum Wells, 2-terminal Quantum Wires, Buckyballs, Carbon Nanotubes, Nano Peapods, Nano Rods, Polymer-based Nanostructures, Gold Nanostructures: Nano-rods, Nano-cages, Nano-shells

Fabrication Techniques: Top-down approach – Nanolithography, CVD; Bottom-up approach – sol-gel process, chemical synthesis, wet deposition techniques, Self-assembly and Layer-by-layer assembly (LbL)

UNIT III

Nanoscale Measurements: Instrumentation: Principle of working, Operational aspects, Limitations, and Applications for: SEM, TEM, STM, SPM, AFM, Fluorescence microscopy

UNIT IV

Nanoelectronics: Materials: Graphene, Boron Nitride Nano-mesh, III-V compounds: GaAs, GaN, AlGaN, InGaAs, High-K/Metal-Gate applications for non-Si nanoelectronics

Devices: Silicon nanowires, Carbon Nanotubes, III-V Quantum Wells, Ballistic deflection transistors (BDT)

Applications: Printed electronics, Molecular electronics, Spintronics, Nanoelectronic displays, Memory devices, Electronics modelled after living systems

UNIT V

Nanomedicine: Nanoprinting of DNA, RNA, and proteins; Site-directed drug delivery: Discovery, delivery, and controlled drug release; Cytotoxicity of Nanoparticles; Nanotechnology in regenerative therapy; Nanotechnology in cancer treatment; NEMS sensors and biosensors; Lab on a Chip (LoC)

Text Books:

1. Poole, C.; Owens, F., "Introduction to Nanotechnology", *Wiley*, 2007 (ISBN: 978-8126510993)
2. Ramachandra, M.S.; Singh, S., "Nano Science and Nanotechnology: Fundamentals to Frontiers", *Wiley India Pvt. Ltd.*, 2013 (ISBN: 978-8126542017)
3. Pradeep, T., "Nano: The Essentials: Understanding Nanoscience and Nanotechnology", *McGraw Hill India*, 2007 (ISBN: 978-0070617889)

References:

1. Bhushan, B. (Ed.), "Springer Handbook of Nanotechnology", *Springer*, 2006 (ISBN: 978-3540298557)
2. Theodore, L., "Nanotechnology: Basic Calculations for Engineers and Scientists", *Wiley India Pvt. Ltd.*, 2011 (ISBN: 978-8126529667)
3. Varghese, T.; Balakrishna, K.M., "Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials", *Atlantic*, 2012 (ISBN: 978-8126916382)

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI31)-BIOMEDICAL INSTRUMENTATION
(Open Elective I)

Course Objectives:

Student will be able to

- Identify and obtain biological parameters and relationship between them.
- Understand the principles involved in acquiring a bio-signal.
- Understand and analyze pre-amplifiers in acquiring various bio-signals and design robust amplifiers.
- Learn fundamental principles of Therapeutic Medical Instrumentation and medical imaging systems.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of mathematics mixed with electronics and use it for designing bio amplifiers.
- Design suitable bio amplifiers in acquiring different bio signals.
- Able to understand the concepts of therapeutic devices and apply them for solving the appropriate problem.
- Able to understand modern imaging equipment like CT, MRI, etc.

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:

Electro-Physiological Measurements: Electro Cardiograph (ECG) – Electro Encephalographic (EEG) – Electromyography (EMG) – Vector Cardiography – Echocardiography, 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.

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 HonghtonMiffince – Bosten

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI32)- REAL TIME AND EMBEDDED SYSTEMS
(Open Elective I)

Course Objectives:

Student will be able to

- Understand different processor technologies, IC Technologies and design technologies.
- Distinguish General purpose processor and Single purpose processor.
- Design the basic communication interfaces.
- Understand the Real Time Operating systems.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- The student is able to optimize the design challenges while designing a Embedded System.
- The students are able to describe advanced state machine computation models for describing complex embedded system behaviour.
- The student should be able to design a Embedded System by using different design technologies.
- Design and develop embedded applications based on real-time operating systems.

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.

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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI33)- DIGITAL IMAGE PROCESSING
(Open Elective I)

Course Objectives:
Student will be able to

- Analyze the images, operations on pixels and study the fundamental steps of image processing and understand the image transformations techniques.
- Understand the principles of image enhancement techniques, Arithmetic and logical operations on images.
- Apply the different image segmentation techniques such as region based segmentation, point detection, line detection and edge detection and color image processing.
- Perform the morphological operations such as Dilation, erosion, boundary, skeleton and image compression models.
- Study the image restorations such as filtering operations, geometrical transforms and special transforms.

Course Outcomes:
On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of image processing to understand real time analysis and different applications of image processing;
- Finally this knowledge can be helpful for implementation of some real time projects and research on image processing applications.
- Analyze and compare various image compression techniques and their applications
- Design and implement various algorithms for image analysis

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 IV:
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.

Text Books:

1. Digital Image Processing- Rafael C. Gonzalez and Richard E.Woods, 3rd Edition, Pearson, 2008.
2. Digital Image Processing- S.Jayaraman, S Esakkirajan, T Veerakumar, TMH, 2010.

References:

1. Digital Image processing – Gonzalez and woods
2. Video processing and communication – Yao Wang, JoernOstermann 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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I Year M.Tech. E&I – I sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(EAI51) - INSTRUMENTATION LABORATORY

Course Objectives:

Student will be able to

- Identifyand obtain process parameters of various processes.
- Understand the principles of controllers, degrees of freedom, control valves.
- Recognize these principles written in form of mathematical equations.
- Apply these equations to analyze problems by making good assumptions and learn system at engineering method to solve practical process control problems.
- Apply fundamental principles of process control for the solution of practical control engineering problems relating to stability analysis of processes.

Course Outcomes:

Upon completion of this course, students should be able to:

- Apply fundamental knowledge of mathematics to modelling and analysis of fluid flow, level, pressure, temperature problems.
- Conduct experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Understand or become aware of disasters caused by an incorrect analysis in hydraulic, Pneumatic engineering system.
- Acquire the knowledge of measurement of various parameters.

(Minimum of 12 experiments should be conducted)

1. Measurement of strain using strain gauge
2. LVDT – characteristics
3. Piezoelectric transducers
4. Accelerometers
5. Characteristics of pH sensors
6. Characteristics of Conductivity sensors.
7. Stroboscope – measurement of RPM
8. Gyroscope – measurement of Torque
9. Measurement of Density and Viscosity of Fluid
10. Flow measurement of liquid using Ultrasonic Doppler effect
11. PID pressure controller
12. Multi loop control systems – Ratio control
13. Multi loop control systems – Cascade Control
14. Interacting and non interacting system
15. pH Control System
16. Signal Conditioning for RTD, Thermistor and Thermocouple

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	0	**0**	**4**

(EAI61) MINI PROJECT -1

A mini project work shall be carried out on any topic of Electronics & Instrumentation and a seminar should be given on the same along with a brief report.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**1**	**4**

(EAI04) - DATA ACQUISITION SYSTEM

Course Objectives:

Student will be able to

- Identify the selection of type of data acquisition system .
- Understand the principles of A/D , D/A Converters, Error Analysis, Display Systems
- Recognize these principles written in form of mathematical equations
- Apply these equations to analyze problems by making good assumptions and learn systematic engineering method to design a good Data acquisition system
- Apply fundamental principles of A/D's , D/A's, Data Acquisition Hardware & Software requirements for the solution of practical high performance Data Acquisition system etc

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of mathematics to modeling and analysis of A/D & D/A's, error analysis on data acquisition systems.
- Conduct case studies indifferent data acquisition systems and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Understand the errors/problems by an improper design analysis in data acquisition system.
- Interface the analog and digital acquisition systems with PC, Analyze and display the out put.

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. 31

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: LCD Flat panel displays, Digital storage CROs, Plasma displays, Projection systems.

UNIT V:

Analyzers – Spectrum Analyzers – guidelines, various triggering techniques, different types of spectrum analyzers, Recorders. Display devices and Display systems, Logic Analyzers – State and time referenced data capture. Scalar and Vector Network analyzers.

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

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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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**1**	**4**

(EAI05) - POWER PLANT INSTRUMENTATION

Course Objectives:

Student will be able to

- Understand and analyze the process of power generation. Measurement and controlling of different plant parameters.
- Identify and innovate the techniques for improving plant efficiency.
- To analyse and identify pollutants in flue gases and industrial waste generated during the process of power generation.
- Innovate ideas to improve plant efficiency, reduce leakages and losses and use technologies for designing and developing pollutant free industrial environment.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Acquire the knowledge of mathematics for deriving mathematical models for different processes in the power plant.
- Use the techniques, skills, and modern engineering tools necessary for industrial engineering practices.
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care and safety, manufacturability, and sustainability.
- Understand and standby the saying one watt saved is equal to two watts generated.

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 Measurement: 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.

References:

1. Standard Boiler Operations - Questions and Answers – by Elonka S.M., andKohal A.L., TMH, New Delhi, 1994
2. Power Plant Instrumentation by Prof. K. Krishna Swamy, Newage International Publisher.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**1**	**4**

(EAI06) - VIRTUAL INSTRUMENTATION

Course Objectives:

Student will be able to

- It provides new concepts towards measurement and automation.
- It gives knowledge about how to control an external measuring device by interfacing a computer.
- To become competent in data acquisition and instrument control.
- It gives knowledge networking
- It provides knowledge on developing different applications in Digital image processing , control system, signal processing, and in simulation.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Acquire knowledge on how virtual instrumentation can be applied for data acquisition and instrument control.
- Identify salient traits of a virtual instrument and incorporate these traits in their projects.
- Experiment, analyze and document in the laboratory prototype measurement
- Acquire knowledge on developing different applications in Digital image processing control system, signal processing and in simulation systems using a computer, plug-in DAQ interfaces and bench level instruments

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 Lab VIEW: Lab VIEW web server, E-mailing data from Lab VIEW, 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,McGrawHill,Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

References:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
2. Rick Bitter, LabVIEW advanced programming technique, 2nd Edition, CRC Press,2005
3. Jovitha Jerome, Virtual Instrumentation using LabVIEW, 1st Edition, PHI, 2001.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI21) - PLC, SCADA PROGRAMMING AND THEIR APPLICATION (ELECTIVE)

Course Objective:

Student will be able to

- Understand the concepts of PLC and SCADA and their application
- Understand PLC based data acquisition - process of collecting information by PLC from real world.
- Understand the remote and networked data acquisition and operating system.
- Understand different types of protocols used in industries.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Describe the main functional units in a PC and be able to explain how they interact, different bus types, and different generations of PCs.
- Explain operating system and able to explain important concepts such as multitasking, privilege levels and drivers.
- Solve simple instrumentation tasks using both PC and microcontroller.
- Provide simple solution for industry problems with PLC and SCADA.

UNIT I:

Programmable Logic Controller (PLC) Basics: Definition, Overview of PLC systems, input/output modules, Power supplies and Isolators.

Basic PLC programming: Programming On-Off inputs/ outputs. Creating Ladder diagrams, Basic PLC functions, PLC Basic Functions, register basics, timer functions, counter functions.

UNIT II:

PLC Intermediate and Advanced Functions: Arithmetic functions, Number comparison functions, Skip and MCR functions, data move systems. Utilizing digital bits, sequencer functions, Matrix functions.

PLC Advanced Functions: Analog PLC operation, Networking of PLC,

UNIT III:

Application of PLC: Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating

UNIT IV:

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, CAN bus.

UNIT V:

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

Text Books:

1. Programmable Logic Controllers – Principles and Applications, John. W .Webb Ronald A Reis , Fourth edition, Prentice Hall Inc., New Jersey, 1998.
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 - GovindRajulu.
4. Inside the PC - Peter & Norton.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI22) - ROBOTICS DESIGN AND CONTROL
(Elective)

Course Objectives:

Student will be able to

- Understand Various types of Robots and applications of robots
- Design of Robotic paths, and areal design of robots
- Understand Controlling of Robots and Configurations of Different Robots

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamental knowledge of Robotics and its applications
- Understand or become aware of design of various Robotics and its usage in industry.
- Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
- Understand the different kinds of controllers and robot vision techniques.

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 McGraw Hill 1994.
2. K.S.Fu, R.C.Gonzalez and C.S.G.Lee," Robotics : Control , sensors , vision and inintlligence ",MCGraw-Hill.1987.

References:

1. M.P.Groover, M. Weiss R.N. Nagel, N.G. Odrey" Industrial Robotics (Technology ,Programming and application s) , McGraw, Hill 1996.
2. J.J.Craig , introduction to Robotics , Addision-wesely 1989. 5) Klafter , Richard D., et al " Robotics Engineering",PhI,1996. 6) Zuech,Nello,"Applying Machine Vision ",john Wiley and sons, 1988.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI23) - MICRO ELECTRO MECHANICAL SYSTEMS
(Elective)

Course Objectives:

Student will be able to

- Obtain knowledge about present MEMS device and their application.
- Understanding the principle laws of physics and chemistry that apply in fabricating a MEMS device.
- Understand different fabrication techniques like micro-machining, etching.
- Apply these techniques and understand some practical models and their working.
- Study the electronic interface and software design tools for MEMS devices.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Understand scaling issues of MEMS based on fundamental knowledge of physics [PO: a}
- Apply various micro manufacturing techniques to fabricate MEMS devices
- Apply techniques of additive manufacturing to MEMS
- Use CAD tools for simulation and layout of MEMS devices

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 oxideprocess, silicon fusion bonding, and anodic bonding.

UNIT III:

Surface Micro Machining: Introduction, sacrificial layer technology, material systems insacrificial layer technology, plasma etching, combined IC technology and anisotropic wetetching

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 devicesusing CAD tools.

Text Books:

1. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.
2. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-VerlagBerlinHeidelberg, 2001.

References:

1. MassoodTabib-Azar, Microactuators - Electrical, Magnetic, Thermal, Optical,Mechanical, Chemical and
2. Smart structures, Kluwer Academic Publishers, NewYork, 1997.
3. Eric Udd , Fiber Optic Smart Structures , John Wiley & Sons, New York, 1995

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI24) PHARMACEUTICAL INSTRUMENTATION
(Elective)

Course Objectives

- To make students understand the working pharmaceutical industry
- To make students understand the necessity of a instrumentation engineer pharmaceutical industry
- To make students understand different components and their control in pharmaceutical industry.

Course Outcomes

Upon completion of this course, students should be able to:

- Appreciate the concept of analytical instrumentation learned during previous semester.
- Appreciate the necessity of homogenization of mixture and size reduction .
- Appreciate evaporation, distillation and filtration process involved in pharma industries .

UNIT I:

Introduction: Pharma Industries Basic Processors and Instrumentation Techniques, Process Analysis Technology (PAT).

Filtration: Classification of Filtration, Mechanism of Filtration, Filter media, Filter Aids, Pre treatment of materials, small scale filtration methods, filtration equipment, filter presses, Leaf filters, stacked disc filters, meta filters, Rotary continuous filters, other methods, ceramic filters, seitz filters, sintered (fritted) Glass filters, Membrane filters, factors affecting the rate of filtration, filter operation, theory of filtration, Limitations of filter theory.

Centrifugation: General principles, theoretical aspects, classification, Laboratory equipment, Large scale equipment, Semicontinuous centrifuge, equipment with non-perforated basket, de laval clarifier, vertical solid bowl centrifuges, continuous centrifuges.

Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimeters.

UNIT II:

Crystallization: Introduction, Crystal forms and crystal Habit, classification of crystallizers, tank crystallizers, agitated batch crystallizers, Swenson Walker Crystallizer, others, Krystal Crystallizer, Vacuum Crystallizer without External Classifying seed Bed, theoretical aspects of Crystallization, Calculation of yields, theory of Crystallization. The miers super saturation theory, limitations of the miers theory, rate of crystal growth, Caking of crystals.

Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields, Material and heat balances around Swenson Walker Crystallizer. Super saturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

UNIT III:

Humidity Control and Refrigeration: Basic concepts and definition, wet bulb temperature, adiabatic cooling lines, use of Humidity chart, determination of humidity, air conditioning, humidification and humidifying equipment, dehumidifiers. Introduction, refrigeration equipment, coefficient of performance and refrigerants, Brine systems, refrigeration load, absorption systems.

Evaporation and Distillation Heat Processes: Factors affecting evaporation, study of evaporating stills and evaporating pans, heat transferring evaporators, vapor compression evaporators and evaporation under reduced pressure. Distillation: Importance of distillation in Pharmacy, methods of distillation. Brief introduction to freeze drying, sublimation, desiccation and exsiccation, efflorescence and its importance.

UNIT IV:

Size Reduction and Separation: Introduction, mechanism and principles of size reduction, classification of size reduction equipment, law of size reduction, large equipment, mills using impact force for size reduction, cage mills, pin mills, fluid energy or jet mills, attrition and grinding mills tumbling mills. Ball mills and tube mills, practical size classifiers used with grinding mills, wet classifiers, non-rotary ball and bead mills, dry vs wet grinding, end runner mill, edge runner mills, disc attrition mills, dispersion and colloid mills, roller mills, size reduction combined with other operations, factors influencing choice of size reduction machinery, changes resulting in the material due to size reduction.

size separation sieving, Screening equipment, sedimentation, screen analysis Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc. Various methods and equipments employed for size separation, centrifugal elutriation, microscopic methods.

UNIT V:

Mixing and Homogenization: Introduction, equipment for4 mixing of miscible liquids, mixing of a soluble solid with a low viscon liquid etc., mixing solids with solids, equipment, consideration while choosing solids mixing equipment, theory of mixing, mixing solids with liquids, mixing miscible liquids, mixing viscous masses, mixing of immiscible liquids, equipment for emulsification.

Theory of mixing, solid solid, solid liquid and liquid liquid mixing equipment, double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.Semi solid mixing, Triple roller mill.

Text Books:

1. Pharmaceutical Engineering . K. Samba Murthy,
2. Pharmaceutical Engineering CVS Subhramanyam,.
3. Tutorial Pharmacy, S.J. Carter, Cooper and Gunn's, 6th ed., CBS publisher, Delhi.

References:

1. Perry's Handbook of Chemical Engineering.
2. Unit Operations by Mc Cabe & Smith.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI25) INDUSTRIAL ELECTRONICS
(Elective)

Course Objectives:

- To make students understand the application of Amplifiers in industries
- To make students understand the need and working of SCR.
- To make students understand the need of different operation of SCR and their industrial applications.

Course Outcomes:

Upon completion of this course, students should be able to:

- Appreciate the need of DC amplifiers,RPS and SMPS
- Appreciate the need for SCR and different firing angle.
- Appreciate the application of SCR to DC motor control, working of industrial timers,
- Appreciate the working of electrodes and RF generators.

UNIT I:

DC Amplifiers: Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT II:

Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.

UNIT III:

Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators—Current boosting .

UNIT IV:

SCR, Thyristor and its Applications: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and F, Ratings of SCR.

Static circuit breaker, Protection of SCR, Inverters—Classification, Single Phase inverters, Converters – single phase Half wave and Full wave.

Chopper circuits – Principle, methods and Configurations, Diac and Triac, Triacs – Triggering modes, Firing Circuits, Commutation.

Design of power supplies and regulators.

UNIT V

Industrial Applications: Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications.Ultrasonics – Generation and Applications.

Text Books:

1. Industrial and Power Electronics – G.K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
2. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

References:

1. Electronic Devices and circuits – Theodore.H.Bogart, Pearson Education,6th Edn., 2003.
2. Thyristors and applications – M. Rammurthy, East-West Press, 1977.
3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI26) - INSTRUMENTATION AND CONTROL IN PAPER AND PULP INDUSTRIES (Elective)

Course Objectives:

Student will be able to

- Identify the different paper making processes and the differences between them
- Understand the principles of measurement of moisture, basic weight, caliper, brightness, Consistency, pH, ORP etc.
- Recognize these principles written in form of mathematical equations
- Apply these equations to analyze measurement of different parameters by making good assumptions and learn systematic engineering method to solve practical problems
- Apply fundamental principles of paper measurements for the solution of practical analysis of moisture, basic weight, caliper, brightness, Consistency, pH, ORP etc

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Apply fundamentalknowledgeofmathematicstomodelingandanalysisofmoisture, basic weight, caliper, brightness, Consistency, pH, ORP in pulp and paper industries. [POs:a,b, e];
- Conduct company visits and field study in different industries and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports. [POs: a, b, d, g, k];
- Understand measuring of different parameters caused by an incorrect analysis in engineering system. [POs: a, e];
- Understand the Paper Process methodology and instrumentation involved in.

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.VanNostrandReinbold 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,AdamHilger 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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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(PES41) -RELIABILITY ENGINEERING
(Open Elective II)

Course Objectives:

Student will be able to

- Understand the concepts of Reliability and Unreliability
- Derive the expressions for Probability of failure, Expected value and standard deviation of Binominal distribution, Poisson distribution, normal distribution and weibull distributions.
- Formulating expressions for Reliability analysis of series-parallel and Non-series parallel systems
- Deriving expressions for Time dependent and Limiting State Probabilities using Markov models.

Course Outcomes :

Upon completion of this course, students should be able to:

- Apply fundamental knowledge of Reliability to modeling and analysis of series- parallel and Non-series parallel systems.
- Solve some practical problems related with Generation, Transmission and Utilization of Electrical Energy.
- Understand or become aware of various failures, causes of failures and remedies or failures in practical systems.
- Applying Reliability concepts to Practical systems by making some assumptions.

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.

References:

1. “Reliability Engineering: Theory and Practice”, By Alessandro Birolini,Springer Publications.
2. “An Introduction to Reliability and Maintainability Engineering”, CharlesEbeling, TMH Publications.
3. “Reliability Engineering”, E. Balaguruswamy, TMH Publications.

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	3	**0**	**3**

(EAI41) - CPLD AND FPGA ARCHITECURES AND APPLICATIONS
(Open Elective-II)

Course Objectives:

Student will be able to

- To introduce the student to digital design using Field Programmable ICs, and to provide an understanding of the underlying technologies and architectures of these Integrated Circuits.
- Underlying Field Programmable and Complex Programmable Logic IC architectures and technologies in detail.
- Structure of SRAM-based, Anti fuse- based & EPROM-based FPGAs and sample architectures
- Describing partitioning techniques to help logic synthesis provide the optimal logic network and also familiarize with the concepts of Placement and Routing algorithms for FPGAs
- Knowledge about EDA Tools for FPGAs & ASICs and specific case studies are presented.

Course Outcomes:

On successful completion of this course, it is expected that students should be able to

- Classify programmable architectures.
- understand comprehending FPGA and CPLD technologies
- Know how to minimize chip area, interconnect wire length, delays.
- Learn use tools for implementing digital logic using a FPGA device.

UNIT I:

Introduction to Programmable Logic Devices: Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT II:

Field Programmable Gate Arrays: Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT III:

SRAM Programmable FPGAs: Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT IV:

Anti-Fuse Programmed FPGAs: Introduction, Programming Technology, Device Architecture, TheActel ACT1, ACT2 and ACT3 Architectures.

UNIT V:

Design Applications: General Design Issues, Counter Examples, A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture.

Text Books:

1. Field Programmable Gate Array Technology - Stephen M. Trimberger, Springer International Edition.
2. Digital Systems Design - Charles H. Roth Jr, LizyKurian John, Cengage Learning.

References:

1. Field Programmable Gate Arrays - John V. Oldfield, Richard C. Dorf, Wiley India.
2. Digital Design Using Field Programmable Gate Arrays - Pak K. Chan/SamihaMourad, Pearson Edition.
3. Digital Systems Design with FPGAs and CPLDs - Ian Grout, Elsevier, Newnes.
4. FPGA based System Design - Wayne Wolf, Prentice Hall Modern Semiconductor Design Series.

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I Year M.Tech. E&I – II sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(EAI42) - NEURAL NETWORKS AND FUZZY SYSTEMS
(Open Elective-II)

Course Objectives:
Student will be able to

- To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.
- To expose the students to the concepts of feed forward Neural Networks and about feed back Neural Networks
- To teach about the concepts of Fuzziness involved in various systems and comprehensive knowledge of Fuzzy logic control and to design the Fuzzy control

Course Outcomes:
On successful completion of this course, it is expected that students should be able to

- Understand the concepts of feed forward neural networks.
- Acquire adequate knowledge about feedback neural networks.
- Acquire the concept of fuzziness involved in various systems.
- Acquire knowledge about fuzzy set theory.

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, Integrate and- 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 Books:

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.

References:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. BapiRaju, 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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	0	**3**	**2**

(EAI52) - VIRTUAL INSTRUMENTATION LABORATORY

Course Objectives:

Student will be able to

- It provides new concepts using Data acquisition card
- It gives knowledge about how to control an external measuring device by Interfacing a computer.
- It gives knowledge to develop the image processing applications
- Gives knowledge to develop the control system and signal simulation applications
- Gives knowledge on DSP Application

Course Outcomes:

On successful completion of this course, it is expected that students should be able to:

- Design and Implement Data acquisition and control sequences using the Lab VIEW software development tool
- Perform experiments on electrical circuits to determine their frequency response and characteristics of components etc (using NI Elvis)
- Perform the image processing techniques on images using Vision Assistant module
- Develop the control system and signal simulation applications using CDSM and DSP toolkit

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 usingLabVIEW

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

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EAI62 - MINI PROJECT -2

A mini project work shall be carried out on any topic of Electronics & Instrumentation and a seminar should be given on the same along with a brief report.

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(EAI63) -COMPREHENSIVE VIVA VOCE

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(EAI71) – INTERNSHIP/DISSERTATION PHASE-I

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(EAI72) - DISSERTATION PHASE -II

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