



RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2019 – 2020

(Revised Scheme)

ELECTRONICS AND INSTRUMENTATION ENGINEERING

III & IV SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU)

Bangalore – 560054.

About the Institute:

Ramaiah Institute of Technology (RIT) (formerly known as M.S.Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with “A” grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT has a strong Placement and Training department with a committed team, a good Mentoring / Proctorial system, a fully equipped Sports department, large air-conditioned library with over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64th rank in 2019 among the top 100 engineering colleges across India.

About the Department:

Department of Instrumentation Technology was established in the year 1992 and renamed as Electronics and Instrumentation Engineering in the year 2014 by VTU. The department has been accredited by NBA. The synergy of the progressive management, committed faculty, staff, and students are ensuring in excellent academic results year after year. The department is well equipped with modern laboratories and has one of best state of art PLC and SCADA laboratory with Allen Bradley PLCs and SCADA from Schneider Electric. The department has an active MoU with Mitsubishi Electric India Pvt Ltd.

The goal and objective of the department is to prepare the students Industry-ready by aligning Electronics and Instrumentation Engineering education program to the current technology and the best practices in the area of Embedded system, Sensor technology and Industrial Automation technologies in general and specially for deployment of these technologies in building Industrial Automation Systems with latest advances in Information, Communication and Networking.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization.
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations.
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs.

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISION OF THE DEPARTMENT

To become centre of excellence in the field of Electronics and Instrumentation Engineering for education and research.

MISSION OF THE DEPARTMENT

To empower and imbibe students with technical knowledge and practical skills in the field of Electronics and Instrumentation Engineering, enabling them to work as professionals in globally competitive environment and contribute to the society through research and higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: To analyze and solve problems in Electronics and Instrumentation Engineering related to industry and research by applying knowledge in mathematics, physical science and engineering.

PEO 2: To design and commission an industrial automation system.

PEO 3: To communicate effectively, work with team, practice professional ethics, and engage in lifelong learning.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Identify, analyze, design and implement—problems in diverse and multidisciplinary background emphasizing control and industrial automation, using modern tools.

PSO2: Understand the impact of engineering solutions in societal, environmental context and manage the projects efficiently.

PSO3: Adhere to professional ethics, lifelong learning, team building skills and communicate effectively.

**Semester wise Credit Breakdown for B E Degree Curriculum
Batch 2018-22**

Semester Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	9	8	4	4					25
Engineering Sciences (ESC)	11	10							21
Humanities, Social Sciences and Management (HSMC)		2			3		3		8
Professional Courses – Core (PCC)			21	21	15	11	10		78
Professional Courses– Elective (PEC)					3	3	6	3	15
Other Open Elective Courses (OEC)					3	3			6
Project Work (PROJ), Internship (IN)						4	1	17	22
Total Credits	20	20	25	25	24	21	20	20	175

SCHEME OF TEACHING III SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1.	EI31	Engineering Mathematics III	BS	3	1	0	4	5
2.	EI32	Analog Circuits and Systems	PC-C	4	0	0	4	4
3.	EI33	Linear Networks	PC-C	3	1	0	4	5
4.	EI34	Digital System Design	PC-C	4	0	0	4	4
5.	EI35	Electronic Measurements	PC-C	3	0	0	3	3
6.	EI36	Industrial Instrumentation	PC-C	4	0	0	4	4
7.	EIL37	Analog Circuits and Systems Lab	PC-C	0	0	1	1	2
8.	EIL38	Digital System Design Lab	PC-C	0	0	1	1	2
9.	AM01*	Additional Mathematics - I	BSC	3	0	0	0	3
Total				24	2	2	25	32

* Non Credit Mandatory Course L – Lecture (one hour) T - Tutorial (Two hours) P - Practical (Two hours)

Note:

- The Non Credit Mandatory Course, Additional Mathematics – I is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.
- AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
 Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. Students transferred from other Universities/Colleges to 5th Semester are required to earn 50 activity points from the year of entry to VTU. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
 Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

SCHEME OF TEACHING IV SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1.	EI41	Engineering Mathematics IV	BS	3	1	0	4	5
2.	EI42	Signal Processing	PC-C	2	1	0	3	4
3.	EI43	Embedded Controllers	PC-C	4	0	0	4	4
4.	EI44	Process Instrumentation	PC-C	4	0	0	4	4
5.	EI45	Control Systems	PC-C	3	1	0	4	5
6.	EI46	Sensors & Analytical Instrumentation	PC-C	4	0	0	4	4
7.	EIL47	Embedded Controllers Lab	PC-C	0	0	1	1	2
8.	EIL48	Industrial Instrumentation Lab	PC-C	0	0	1	1	2
9.	AM02*	Additional Mathematics - II	BSC	3	0	0	0	3
Total				23	3	2	25	33

* Non Credit Mandatory Course L – Lecture (one hour) T - Tutorial (Two hours) P - Practical (Two hours)

Note:

- The Non Credit Mandatory Course, Additional Mathematics – II is prescribed for IV Semester Lateral Entry Diploma students admitted to BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.
- AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
 Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. Students transferred from other Universities/Colleges to 5th Semester are required to earn 50 activity points from the year of entry to VTU. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
 In case student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

III Semester

ENGINEERING MATHEMATICS - III

Course Code: EI31

Credit: 3:1:0

Prerequisite: Calculus

Contact Hours: 42+14

Course Coordinators: Dr. M. V. Govindaraju, Dr. M. Girinath Reddy

Course Content:

Unit I

Numerical solution of Algebraic and Transcendental equations: Method of false position, Newton - Raphson method.

Numerical solution of Ordinary differential equations: Taylor's series method, Euler's and modified Euler's method, Fourth order Runge-Kutta method.

Statistics: Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves. Correlation and Regression.

Unit II

Linear Algebra: Elementary transformations on a matrix, Echelon form of a matrix, Rank of a matrix, Consistency of system of linear equations, Gauss elimination and Gauss – Seidel method to solve system of linear equations, Eigen values and Eigen vectors of a matrix, Rayleigh power method to determine the dominant Eigen value of a matrix, Diagonalization of a matrix, Solution of system of ODEs using matrix method.

Unit III

Complex Variables-I: Functions of complex variables, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates, Consequences of Cauchy-Riemann equations, Construction of analytic functions.

Transformations: Conformal transformation, Discussion of the transformations -

$$w = z^2, w = e^z \text{ and } w = z + \frac{a^2}{z} \quad (z \neq 0), \text{ Bilinear transformation.}$$

Unit IV

Complex Variables-II: Complex integration, Cauchy theorem, Cauchy integral formula. Taylor and Laurent series (statements only). Singularities, Poles and residues, Cauchy residue theorem (statement only).

Unit V

Fourier series: Convergence and divergence of infinite series of positive terms, Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period. Half range Fourier series. Fourier series for Periodic square wave, Half wave rectifier, Full wave rectifier, Saw-tooth wave with graphical representation. Practical harmonic analysis.

Text Books

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. B. S. Grewal – Higher Engineering Mathematics – Khanna Publishers – 44th edition – 2017.

References

1. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.
2. Dennis G. Zill, Michael R. Cullen - Advanced Engineering Mathematics, Jones and Barlett Publishers Inc. – 3rd edition – 2009.
3. Dennis G. Zill and Patric D. Shanahan- A first course in complex analysis with applications- Jones and Bartlett publishers-second edition-2009.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply numerical techniques to solve engineering problems and fit a least squares curve to the given data. (PO-1,2; PSO-1,3)
2. Test the system of linear equations for consistency and solve system of ODE's using matrix method. (PO-1,2; PSO-1,3)
3. Examine and construct the analytic functions. (PO-1,2; PSO-1,3)
4. Classify singularities of complex functions and evaluate complex integrals. (PO-1,2; PSO-1,3)
5. Construct the Fourier series expansion of a function/tabulated data. (PO-1,2; PSO-1,3)

ANALOG CIRCUITS & SYSTEMS

Course Code: EI32

Credit: 4:0:0

Prerequisite: Basic Electronics (EC15)

Contact Hours: 56

Course Coordinator: Dr. Pushpa M. K.

Course Content:

Unit I

Transistors: Construction and working principle, characteristics of JFET, Comparison of JFET and BJT, Biasing of JFET, JFET small signal model, Analysis of FET Common source amplifier with bypassed R_s and unbypassed R_s , Common drain amplifier with unbypassed R_s , Common gate amplifier with unbypassed R_s . **MOSFET:** Construction, Characteristics and working principle of Enhancement MOSFET, Depletion MOSFET.

Unit II

Parameters of OP-amps: Characteristics of OPAMP -I/P resistance, O/P resistance, CMRR, slew rate, open loop voltage gain, Bandwidth, input offset voltage, output offset current, Bias current. **Op-amp Applications:** Basic circuits, Differential amplifier, Instrumentation amplifiers, Instrumentation amplifier using transducer bridge, V to I converters, constant current sources, Comparators, Schmitt triggers, square wave generator, Introduction to Simulation using Multisim simulator.

Unit III

Active Filters using Op-amps: Comparison of Active & Passive filters, I and II order Butterworth Low Pass Filter, High Pass Filter, Band Pass Filter and Band Elimination Filter. **Oscillators using Op-amp:** Principles of Oscillators, Wien Bridge, RC phase shift oscillator, Colpitts, Hartley, Crystal oscillators.

Unit IV

555 Timer and Applications: Functional block diagram, Monostable multivibrator and applications, Astable multivibrator and applications. Voltage to Frequency & Frequency to voltage converter. **PLL (565 PLL):** Basic principle, Phase detectors, Integrated circuit PLL, applications of PLL.

Unit V

Voltage Regulators: Need for Voltage regulators, Block diagram of a linear regulator, Classification of regulators- Series Regulator, Shunt Regulator. IC voltage regulators - 78XX, 79XX, IC regulator used as a current source, Fixed IC regulator used as adjustable regulator. **General purpose regulator IC723-** Pin details, Low voltage and High voltage regulators. Introduction to Switching mode regulator, RLC type switching regulator.

Text Books

1. Ramakanth A Gayakwad, Opamps and Linear Integrated Circuits,4th Edition, PHI.
2. Robert L Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, PHI, 2006.

References

1. MILLMAN - HALKIAS, Integrated Electronics, 33rd reprint TMH 1991.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Derive the necessary equations and design amplifiers for specified conditions. (PO-1,2,3,4,5,10; PSO-1)
2. Analyze various parameters of Op-amps and design suitable signal conditioning circuits. (PO-1,2,3,4,5,9,10; PSO-1)
3. Compare various types of filters, design filters and signal generators. (PO-1,2,3,4,5,10; PSO-1)
4. Use Timers and PLL for various IC and analog circuits based applications. (PO-1,2,3,4,5,10,11,12; PSO-1,2,3)
5. Describe the operation and design of voltage regulators. (PO-1,2,3,4,5,10; PSO-1)

LINEAR NETWORKS

Course Code: EI33

Credit: 3:1:0

Prerequisite: Basic Electrical Engineering (EE25)

Contact Hours: 42+14

Course Coordinator: Mrs. K M Vanitha

Course Content:

Unit I

Passive Networks: V-I characteristics of idealized elements of networks, Sources: Independent (Ideal & practical), Dependent sources, Basic Laws (including Source transformation), Loop Analysis & Nodal Analysis with linearly dependent & independent sources for DC & AC networks (Concept of Supermesh & Supernode), Star-Delta transformation, Duality in electrical networks, Applications to transistor circuits.

Unit II

Network Theorems: Superposition Theorem, Thevenin's & Norton's theorem, Maximum Power transfer theorem, Reciprocity & Millman's theorem, Application: Resistance measurement.

Unit III

Transient Behavior and Initial Conditions: Behavior of circuit elements under switching condition & their representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for DC & AC Excitation. **Resonant Circuits:** Series & Parallel resonance, Frequency response of Series & Parallel circuits, Applications: Radio Receiver, Touch tone telephone.

Unit IV

One Port Networks: Review of Laplace transforms, Initial & final value theorem, convolution theorem, Periodic & Aperiodic waveforms, Time response of One-Port passive networks, Frequency domain behavior, Application: Network stability.

Unit V

Two Port Networks: Definition of Z, Y, h & T parameters, modeling with these parameters, Relationships b/n 2 port n/w parameters, Interconnection of 2 port n/w s, Applications: Transistor circuits.

Text Books

1. N.O. Sadiku, Charles K. Alexander & Matthew, Fundamentals of Electric Circuits, 4th Edition, TMH publishers, 2013.
2. Hayt, Kemmerley and Durbin, Engineering Circuit Analysis, TMH 8th Edition, 2015.

References

1. Artice M Davis: Linear Circuit Analysis, 1998, PWS Pub. Co.
2. David K. Cheng, Analysis of Linear Systems, Narosa Publishing House, 11th reprint, 2002
3. Bruce Carlson, Circuits, Thomson Learning, 2000. reprint 2002
4. M.E. Van Valkenburg, Network analysis, PHI/Pearson Education, 3rd Edition, reprint 2002.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply the basic electrical laws and reduction techniques to solve circuit problems. (PO-1,2,10; PSO-1,3)
2. Apply network theorems to simplify electric circuits. (PO-1,2,10; PSO-1,3)
3. Analyze transient behavior of electric circuits and resonance conditions. (PO-1,2,10; PSO-1,3)
4. Analyze the behavior of linear circuits using Laplace transform and evaluate transfer function of single port networks. (PO-1,2,10; PSO-1,3)
5. Evaluate two port network parameters. (PO-1,2,10; PSO-1,3)

DIGITAL SYSTEM DESIGN

Course Code: EI34

Credit: 4:0:0

Prerequisite: Basic Electronics (EC15)

Contact Hours: 56

Course Coordinator: Dr. M. Jyothirmayi

Course Content:

Unit I

Introduction to Different Logic Families: Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. TTL inverter - circuit description and operation, TTL NAND - circuit description and operation, Open collector TTL and Tristate TTL, MOS NAND and NOR Circuits: circuit description and operation, CMOS inverter - circuit description and operation, CMOS NAND and NOR - circuit description and operation. **Combination Logic:** Review of K-maps (up to 4 variables), Map entered variables. **Introduction to Verilog:** Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Behavioral description.

Unit II

Combinational Functions: Arithmetic Operations Adders: parallel adders, serial, Fast adders, and Subtractor: - using 1's and 2's compliment, Comparators – 2 bit and four bit, two bit Multiplier, Verilog Description for above circuits. **Multiplexers-** Realization of 2:1, 4:1 and 8:1 using gates & Applications. **Demultiplexers:** - Realization of 1:2, 1:4 and 1:8 using basic gates & Applications, Verilog description of Multiplexers and Demultiplexers.

Unit III

Encoding and Decoding Codes: Binary coded decimal codes, BCD – Gray vice versa, BCD – Excess 3; Encoders: Realization and Priority Encoders, Decoders: BCD – Decimal, BCD – Seven segment, Seven segment display. Programmable Logic Devices: PLA, PAL Verilog description of Encoders and Decoders.

Unit IV

Sequential Logic Circuits: Latches and Flip-Flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop Master slave FF, Edge trigger and Pulse trigger FF, Registers and Shift Registers: PISO, PIPO, SISO, SIPO, Right shift and left shift, Universal Shift register Ring and Johnson counters. **Counters, design and their applications:** Modulo N counters – Synchronous and Asynchronous counters.

Unit V

Synchronous Sequential Circuits: Moore and Mealy Machines: Definition of state machines, state machine as a sequential controller Design of state machines: state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples-Algorithmic state machines – Algorithmic state machines, ASM Charts, Examples using ASM charts.

Text Books

1. Donald D Givone, Digital Principals and Design,12th reprint, TMH,2008
2. Morris Mano, Logic and Computer design fundamentals, 4th edition,PHI,2006
3. Nazeih M. Botros, HDL Programming VHDL And Verilog 2009 reprint, Dreamtech press.

References

1. Tocci, Digital systems principle & applications, 8thEdition, PHI 2004
2. Donald P Leach, Albert Paul, Malvino, Goutam Saha, Digital Principles and Applications, 6thEdition TMH, 2006.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Acquire knowledge and perform reduction of logic functions using simplification techniques. (PO-1,2,9, PSO-1,3)
2. Identify, analyze and design combinational circuits. (PO-1,2,3,5,9, PSO-1,3)
3. Write verilog code using data flow and behavioral description. (PO-1,2,3,5,9,12 PSO-1,3)
4. Analyze and design various Sequential circuits.(PO-1,2,3, 9,12,PSO-1,3)
5. Use the concepts of state transition for analysis and design of synchronous and asynchronous sequential circuits.(PO-1,2,3,9,12 PSO-1,3)

ELECTRONIC MEASUREMENTS

Course Code: EI35

Credit: 3:0:0

Prerequisite: NIL

Contact Hours: 42

Course Coordinator: Mrs. Vibha B. Raj

Course Content:

Unit-I

Introduction: Introduction to Measurement and electronic measurement techniques, Elements of generalized measurement system, I/O configuration of measuring instruments and measuring systems, Methods of correction for interfering and modifying inputs, Static and Dynamic characteristics, Types of errors in measurement, calculate errors in measurement.

Unit-II

Introduction to and factors for the selection of transducers: Transducers, Classification: primary-secondary, active-passive and analog-digital. **Measurement of R, L & C:** DC bridges: Wheat Stone bridge, problems, Megger, Earth resistance measurements, Q-meter measurement of R, L and C. **Oscilloscope:** Oscilloscope, Digital storage oscilloscope, Measurement of frequency, phase, voltage and current using CRO.

Unit-III

Measuring instruments: AC Voltmeter using rectifiers, True RMS responding voltmeter, Electronic Multi-meter, types of digital voltmeters: Single-ramp, Dual-ramp, Low current measurements: leakage currents & its guarding, generated currents, applications: photomultiplier tubes; Low voltage measurements: thermoelectric EMFs, magnetic fields, ground loops, applications: standard cell comparisons.

Unit-IV

Function Generator & Data converters: Function generator, **ADCs:** Classifications, specifications, Flash Type ADC, Successive approximation ADC, General Applications of ADCs. **DACs:** Classifications, specifications, Binary weighted type DAC, R-2R type DAC, General Applications of DACs.

Unit-V

Data Acquisition Systems: Introduction to DAS, Analog Switches and Multiplexers, Sampling fundamentals, Sample and Hold circuit & specifications, case study of typical data acquisition systems, Data loggers.

Text Books

1. “Modern Electronic Instrumentation and Measurement Techniques”, W.D. Cooper, PHI/Pearson, 2015
2. “Measurement systems application and design”, E.O.Doeblin 5th edition TMH
3. “Electronic Measurements and Instrumentation”, Oliver-Cage, Volume-12, Tata McGraw Hill

References

1. “A course in Electrical & Electronics measurement and Instrumentation”, A.K Sawhney, 19th revised edition 2011, reprint 2014, Dhanpat Rai & Sons.
2. “Low level measurement Handbook”, 7th edition, Keithley Instruments.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Explain the instrument characteristics, errors, calibration and analysis of the generalized measurement system. (PO-1,7,10, PSO-1,2,3)
2. Use the bridge circuits to find the unknown parameters of R, L, C; and utilization of CRO for the measurement of the required parameters. (PO-1,2,10, PSO-1,3)
3. Describe the functioning of voltmeter with their principles; and circuits to measure low values of V and I. (PO-1,2,7, PSO-1,2)
4. Describe the functioning of function generator and data converters. (PO-1,2,3,7, PSO-1,2)
5. Describe the working of acquisition systems and logger systems. (PO-1,2,7, PSO-1,2)

INDUSTRIAL INSTRUMENTATION

Course Code: EI36

Credit: 4:0:0

Prerequisite: NIL

Contact Hours: 56

Course Coordinators: Dr. H. S. Niranjana Murthy and Dr. Christina Grace

Course Content:

Unit I

Introduction & Calibration: Overview of instrumentation, Instrument Classification, Transducer classification, Calibration procedures, Calibrating instruments, Control equipment; **Displacement:** Standards, Resistive Potentiometer, LVDT and signal conditioning circuits, Capacitive transducers and Wein bridge oscillator, Applications of Displacement transducer.

Unit II

Pressure: Standards, Different methods of pressure measurement, Different types of manometers, Elastic pressure transducers: Bourdon tube, Diaphragm type, Bellows; Electrical transducers: Capacitance based, Piezoelectric based, Strain gauge based; High pressure measurement, Differential pressure transmitters: Pneumatic nozzle-flapper amplifier, relay; Vacuum pressure measurement: Pirani, Ionization, Thermocouple, McLeod, Knudsen gauge; Applications of Pressure Transducers.

Unit III

Temperature: Standards, Thermal expansion methods: Bimetallic, Liquid in glass, Pressure thermometers; Thermocouple – laws, reference junction considerations, thermoelectric series, thermopiles, Resistance Temperature Detector – theory, different constructions, signal conditioning, Thermistor, Junction semiconductor sensors, Thermowells, Radiation based temperature measurement – Laws, Blackbody Concepts, Different types of Optical pyrometers: Total – Fery's, Selective –Disappearing filament & IR, Ratio type; Very low temperature measurements.

Unit IV

Strain Gauge: Introduction, Gauge sensitivity, Types of strain gauges and rosettes, Signal conditioning circuits, Temperature Compensation, Applications of Strain Gauge.

Vibration & Sound: Vibration: characteristics, types, mathematical model, importance of measurement, choice of transducers, applications; Stroboscope, Reed vibrometer, Seismic transducers: displacement pickup, velocity pickup, acceleration pickup - potentiometric, LVDT, strain gauge, piezoelectric; Basics of sound measurement, Microphones: Condenser type, Electret, Piezoelectric, Electrodynamic.

Unit V

Force, Torque: Basic methods of Force measurement, Load cells, Strain gage based force measurements: advantages, types, classifications, specifications, signal conditioning; Hydraulic and Pneumatic load cells, Piezoelectric type, Basics of torque measurement, Torque measurement: Dynamometer- Cradling sink, Prony brake, Strain gauge – Slip ring arrangement, Rotary transformer, Telemetry type. **Humidity and Moisture:** Definitions and basic theory, dry and wet bulb psychrometers, hot wire electrode type hygrometer, dew cell, electrolysis type hygrometer, commercial type dew point meter, Different methods of moisture measurement –in granular materials, solid penetrable materials like wood, web type material.

Text Books

1. E.O.Doeblin, Measurement systems application and design, 4th Edition, TMH
2. B.C.Nakra and K.K. Choudhury, Instrumentation Measurement and Analysis, Tata McGraw-Hill Education, 2nd Edition, 2003

References

1. John. P. Bentley, Principle of Measurement System, 3rd Edition, Pearson, 2007
2. Bela .G. Liptak, Process Measurement Handbook.
3. N.E. Battikha, The condensed handbook of measurement and control, 4th Edition, ISA, 2018

Course Outcomes (COs):

At the end of the course, students will be able to

1. Define and explain the theory behind various measurement techniques and derive the necessary equations (PO-1,2,3,9, PSO-1,3)
2. Describe the working principle of instruments used for the measurement of displacement, pressure, temperature, strain, vibration, sound, force, torque, humidity and moisture. (PO-1,2,3,9, PSO-1,3)
3. Illustrate the importance and advantages of each measurement variable & classify, compare or choose instruments for a given application. (PO-1,2,3,9, PSO-1,3)
4. Estimate the value of output or input variables by applying necessary equations and solving numerical problems pertaining to measuring instruments. (PO-1,2,3,4,10,12, PSO-1,3)
5. Design signal conditioning circuits for measuring instruments, for obtaining accurate output response by minimizing errors due to environmental conditions and other factors (PO-1,2,3,4,10,12, PSO-1,3)

ANALOG CIRCUITS AND SYSTEMS LAB

Course Code: EIL37

Credit: 0:0:1

Prerequisite: Nil

Contact Hours: 14

Course Coordinator: Dr. Pushpa M. K.

List of Experiments:

1. Opamp Applications: Integrator, differentiator.
2. Current amplifier -I to V convertor, V to I convertor.
3. Simulate Integrator, Differentiator, I to V and V to I convertors.
4. Instrumentation amplifier (Using IC).
5. Schmitt trigger and square wave generator.
6. Simulate IT amplifier, Schmitt Trigger and square wave generator.
7. Active filters – 2nd order: Low pass filter, High pass filter.
8. Realization of oscillators using Opamp Wein Bridge and Crystal Oscillator.
9. Simulate filters and oscillators.
10. Low and high voltage regulator using IC723.
11. Monostable and Astable multi-vibrator using IC555 timer.
12. Simulate regulators and multivibrators.
13. V to F and F to V convertor using IC331.
14. Simulate V to F and F to V convertors.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Design and test various analog circuits for the given specifications. (PO-1,2,3,4,5,10,12, PSO-1,3)
2. Design and test IC555 and voltage regulator for given specification. (PO-1,2,3,4,5,10, PSO-1,3)
3. Simulate circuits using Software tools. (PO-1,2,3,4,5,10,12, PSO-1,3)

DIGITAL SYSTEM DESIGN LAB

Course Code: EIL38

Credit: 0:0:1

Prerequisite: Nil

Contact Hours: 14

Course Coordinator: Dr. Jyothirmayi.

List of Experiments:

Part-A: Hardware

1. Realization of Boolean expressions
2. Adder/ Subtractor: Full/half adders/ subtractors using logic gates, universal gates
3. Parallel Adder/ Subtractor using IC 7483
4. Multiplexer/ Demultiplexer: Use IC 74153, 74139 and solve Boolean expressions
5. Comparators using IC 7485
6. Flip flops, Shift registers, ring and Johnson counters
7. Counters using IC7493/ 74193

Part-B: Software

Software Simulation, Implementation in Test bench and FPGA kit

1. Basic gates, Adders and Subtractors
2. Ripple carry adder using data flow description
3. Multiplexers using behavioral description
4. Encoders/ Decoders/ Priority encoders
5. Code converters and Comparators
6. Up and Down Counters; Shift operations
7. Interfacing with hardware (Stepper motor /7 segment display-demo)

Text Books

1. Digital Design by Morris Mano
2. HDL with Digital Design VHDL & Verilog by N.Botros

Course Outcomes (COs):

At the end of the course, students will be able to

1. Simplify, design and implement combinational circuits like adders, multiplexers and decoders using logic gates and ICs. (PO-1,2,3,5,10, PSO-1,3)
2. Design and implement different sequential circuits like Flip-flops, shift registers and counters. (PO-1,2,3,5,10, PSO-1,3)
3. Implement, synthesize and test verilog codes for combinational circuits, shift registers and counters using FPGA design tool like Xilinx ISE. (PO-1,2,3,5,10, PSO-1,3)

IV Semester

ENGINEERING MATHEMATICS-IV

Course Code: EI41

Credit: 3:1:0

Prerequisite: Calculus & Probability

Contact Hours: 42+14

Course Coordinators: Dr. M. V. Govindaraju, Dr. M. Girinath Reddy

Course Content:

Unit I

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Properties, Inverse transform, Convolution theorem, Parseval's identity (statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems, Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random variables (discrete and continuous), Probability density function, Cumulative distribution function, Mean, Variance and Moment generating function.

Probability Distributions: Binomial and Poisson distributions. Uniform distribution, Exponential distribution, Gamma distribution and Normal distribution.

Unit IV

Joint probability distribution: Joint probability distribution (both discrete and continuous), Conditional probability and Conditional expectation.

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation and Power spectral density.

Markov Chain: Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states. Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of first kind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigue's formula.

Text Books

1. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
2. B.S. Grewal - Higher Engineering Mathematics-Khanna Publishers - 44th edition-2017.

References

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Find functional values, derivatives, areas and volumes numerically from a given data. (PO-1,2; PSO-1,3)
2. Evaluate Fourier transforms and use Z-transforms to solve difference equations. (PO-1,2; PSO-1,3)
3. Analyze the given random data and its probability distributions. (PO-1,2; PSO-1,3)
4. Determine the parameters of stationary random processes and use Markov chain in the prediction of future events. (PO-1,2; PSO-1,3)
5. Obtain the series solution of ordinary differential equations. (PO-1,2; PSO-1,3)

SIGNAL PROCESSING

Course Code: EI42

Credit: 2:1:0

Prerequisite: Engg. Mathematics I & II (MA11 & MA21) **Contact Hours:** 28+14

Course Coordinator: Mr. G. Shivaprakash

Course Content:

Unit I

Introduction: Signals and Systems, Classification of Signals: Continuous & discrete, deterministic and random signals, Odd and even signals, Periodic & aperiodic signals, Causal & Non-causal, Power & Energy signal. Operations on signals: Operations on independent variable, Operations on dependent variable. Elementary CT signals: Unit step, ramp, impulse, exponential signal and sinusoidal signals. Elementary DT signals: Unit step, ramp, impulse, exponential signal and sinusoidal signals. Systems viewed as interconnection of operations.

Unit II

Classification of Systems: CT & DT systems. **Properties of systems:** Linear & non-linear systems, time-variant & time-invariant systems, Causal & Non-causal, stable & unstable systems. Impulse response representation of LTI system. Differential equation representation of LTI systems, Difference equation representation of LTI system. Discrete time Convolution and Correlation.

Unit III

Introduction to Fourier representations, Fourier transforms, Properties of FT: linearity, Timeshift, Frequency shift, Scaling, Differentiation in the time domain, differentiation in the frequency domain, integration in the time domain, convolution, multiplication, Parseval's theorem, duality, symmetry. DTFT representation, properties of DTFT: linearity, time shift, frequency shift, scaling, differentiation in the frequency domain, convolution, multiplication, Parseval's theorem, duality, symmetry.

Unit IV

Applications of signal processing to communication systems: Introduction, types of modulation, benefits of modulation, Full Amplitude modulation, DSSC modulation, Quadrature carrier multiplexing, Single sideband modulation, Vestigial sideband modulation. Multiplexing: Time division multiplexing, frequency division multiplexing.

Unit V

Infinite Impulse response (IIR) Filters: Introduction to digital filters, IIR filter design by approximation of derivatives. Butterworth low pass IIR filter design by impulse invariant transformation and Bilinear transformation. Introduction to frequency transformations.

Text Books

1. Signals and Systems, Symon Haykin and Barry Van Veen, 2/e, John Wiley and Sons.
2. Digital signal processing- S. Salivahanan, A.Vallavaraj and C. Gnanapriya(Chapter 5), Mcgraw Hill.

References

1. Signals and Systems: Alan V. Oppenheim, Alan S. Willsky, and with S. Hamid, PHI
2. Digital signal processing-Proakis and Monolakis, 3rd edition , Prentice Hall of India, 2007
3. Digital signal processing-Alan V. Oppenheim, Ronald W. Schafer , Prentice Hall of India, 1978.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe the various types of signals and systems (PO-1,3,4,9,10; PSO-1,3)
2. Perform operations on the dependent and independent variable of a signal. (PO-1,3,4,9,10; PSO-1,3)
3. Represent continuous and discrete signals in the Fourier domain and solve numerical problems using their properties. (PO-1,3,4,9,10; PSO-1,3)
4. Compare various types of modulation and identify the signal processing concepts used in them. (PO-1,3,4,9,10; PSO-1,3)
5. Classify systems based on their characteristic features and design IIR system to meet the given specifications. (PO-1,3,4,9,10; PSO-1,3)

EMBEDDED CONTROLLERS

Course Code: EI43

Credit: 4:0:0

Prerequisite: Fundamentals of Computing (CS26)

Contact Hours: 56

Course Coordinator: Ms. Elavaar Kuzhali. S

Course Content:

Unit I

Introduction: Introduction to Microprocessors and Microcontrollers, RISC vs CISC, **ARM embedded systems:** The RISC design philosophy, The ARM design philosophy, embedded system hardware, embedded system software. ARM Architecture. **ARM processor fundamentals:** Registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions, ARM processor families

Unit II

Introduction to ARM instruction Set: Data Processing Instructions, Branch Instructions, Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, and Conditional Execution.

Unit III

Introduction to the THUMB Instruction set: Thumb register Usage, ARM-Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load –store Instructions, Multiple register Load Store Instructions, Stack Instructions, and Software Interrupt Instruction.

Unit IV

Interrupts & Exception Handling: Exception Handling Interrupts, Interrupt handling schemes- Non-nested Interrupt Handler Nested Interrupt Handler, reentrant handling scheme.

Unit V

LPC 2148-Design of system using GPIO's (Interface to SWITCH, LED's, LCD interface, 4 x 4 Keypad), Timers, ADC, DAC, UART, SPI.

Text Books

1. “Andrew N.Sloss”, ARM system Developers Guide, Elsevier, 2008
2. “William Hohl”, ARM Assembly Language – Fundamentals and Techniques, CRC Press, 2009
3. “J.R.Gibson”, ARM Assembly language An Introduction, CENGAGE Learning, 2010.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Analyse ARM design philosophy, design rules and describe the functions of ARM embedded hardware and software components. (PO-1, 5, PSO-1)
2. Write programs using ARM instruction set. (PO-1,2,3,4,5,9,10,12, PSO-1,3)
3. Write programs using THUMB instruction set. (PO-1,2,3,5,9,10,12, PSO-1,3)
4. Analyse the various ways of handling exceptions and interrupts in ARM processor. (PO- 1,2,3,4,5,9,10,12, PSO-1,3)
5. Develop embedded C programs to interact with Built in Peripherals of ARM7 LPC 2418. (PO-1,2,3,4,5,9,10,12, PSO-1,3)

PROCESS INSTRUMENTATION

Course Code: EI44

Credit: 4:0:0

Prerequisite: Industrial Instrumentation (EI36)

Contact Hours: 56

Course Coordinators: Ms. J V Alamelu and Dr. H. S. Niranjana Murthy

Course Content:

Unit I

Basic Concept of Fluid Mechanics & Flow of Fluids: Introduction, properties of fluids, viscosity, fluids pressure at a point, properties, laws of pressure, types of fluids, types of fluid flow, rate of flow, equation of continuity, velocity and acceleration, types of motion, linear translation, deformation, angular deformation, rotation, vorticity, forced and free vortex flow

Unit II

Flow of Fluids: Dynamics of flow, equations of motion, Euler's equation, Bernoulli's equation. **Head Type & Quantity Flow meters:** Orifice plate, Venturi tube, Flow nozzle, Pitot tube, Positive displacement flow meters – nutating disc and reciprocation piston.

Unit III

Area & Mass Flow Meters: Turbine flow meter, Rotameter, Coriolis mass flow meters, Thermal mass flow meter, Volume flow meter plus density measurement

Electrical Type Flow Meter: Electromagnetic flow meter – different types of excitation, schemes used, Ultrasonic flow meters, Vortex shedding flow meter, solid flow rate measurement, calibration of flow meters – dynamic weighing method.

Unit IV

Level measurement: Gauge glass technique coupled with photo electric readout system, Float type level indication, Level switches, Level measurement using displacer and torque tube, Bubbler system, Differential pressure type level transducers, Boiler drum level measurement, Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors, Radar type level measurement, Level measurement using laser.

Unit V

pH and viscosity measurement: pH meters, conductivity measurements, Saybolt viscometer, Rotameter type viscometer, Suitable signal conditioners.

Instrument selection, Installation & Maintenance: Guidelines for selection of instruments, Data sheets handling, Ingression protection, Enclosures. Installation – Equipment identification, Pre-installation testing, Execution, Wiring, Tubing, Checkout – lockout & tagout procedures. Maintenance – Implementation, Types, Records, Hazards, Electrical isolation, Programmable electronic systems

Text Books

1. Bansal.R.K, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2005
2. E.O.Doeblin, Measurement systems application and design, 4th Edition TMH.
3. D.Patranabis, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill.

References

1. Radhakrishnan, E., Introduction to fluid Mechanics, Prentice Hall, India 2005.
2. Rajput R.K., Fluid Mechanics and Hydraulic Machines, S.Chand and Co., India.
3. John. P. Bentley, Principle of Measurement System, 3rd Edition, Pearson 2007.
4. Bela .G. Liptak, Process Measurement.
5. N.E. Battikha, The condensed handbook of measurement and control, 4th Edition, ISA, 2018.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Interpret important physical principles of fluid mechanics applied in process instrumentation & solve basic fluid mechanics problems. (PO-1,2,3,6,7,9,10,12, PSO- 1,2,3)
2. Understand the working principle of flow, level, pH and viscosity meters. (PO-1,2,3,6,7,9,10,12, PSO- 1,2,3)
3. Classify and contrast between different types of instruments, and explain the importance, advantages and special features of each instrument. (PO-1,2,3,4,10,12, PSO-1,3)
4. Elucidate the calibration procedures, guidelines for selection, installation and maintenance of instruments and apply it for given process conditions. (PO-3,4,6,7,12, PSO-1,2,3)
5. Design suitable signal conditioning circuits for flow, level, pH and viscosity type instruments and illustrate instrument characteristics. (PO-2,3,4,12, PSO-1,3)

CONTROL SYSTEMS

Course Code: EI45

Credit: 3:1:0

Prerequisite: Linear Networks (EI33)

Contact Hours: 42+14

Course Coordinator: Mrs. K.M. Vanitha

Course Content:

Unit I

Modeling of Systems: Types of Control Systems, Mathematical models of physical systems – Introduction- Differential equations of physical systems (Mechanical systems, Friction, Translational systems) (Mechanical accelerometer, Levered systems excluded), Mathematical models of Rotational systems- Gear trains, Analogous systems. **Block Diagrams and signal flow graphs:** Transfer functions, Block diagram algebra, Signal flow graphs (State variable formulation excluded).

Unit II

Time Response of Feedback Control Systems: Standard test signals, Steady state errors and error constants, Unit step response of First and second order systems, Time response specifications of second order systems, P, PI, PD and PID Compensation, Analysis using MATLAB.

Unit III

Stability Analysis: Concept of Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus & Stability, Dominant Poles, Application of Root Locus Diagram – Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB.

Unit IV

Frequency Domain Analysis: Correlation between time and frequency response, Frequency Response – Bode Plot, Polar Plot, Nyquist Plot – Frequency Domain specifications from the plots – Constant M and N Circles – Nichol's Chart – Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

Unit V

Design of Feedback Control System: Approaches to system design, lead, lag, lead-lag compensator networks and example. Lead, lag, lead-lag compensator design using Bode and Root Locus Techniques, design for deadbeat response.

Text Books

1. J. Nagrath and M.Gopal, Control Systems Engineering, New age International (P) Limited, Publishers, fifth edition – 2007
2. K. OGATA, Modern Control engineering, Pearson Education Asia, 5th Edition.

References

1. Richard C. Dorf , Robert H. Bishop, Modern Control Systems, Pearson education,2004
2. Farid and Kuo, Automatic Control Systems,9th Edition, John Wiley and Sons.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe and develop mathematical models of physical systems. (PO-1,2,5,10; PSO-1,3)
2. Determine transient and steady state behaviour of the system. (PO-1,2,5,10; PSO-1,3)
3. Evaluate the time domain stability of the system using RH criteria and root locus techniques. (PO-1,2,5,10; PSO-1,3)
4. Evaluate the frequency domain stability of the system using Bode plot and Nyquist criterion. (PO-1,2,5,10; PSO-1,3)
5. Design and analyze control system in time and frequency domain. (PO-1, 2,3,5,10; PSO-1,3)

SENSORS AND ANALYTICAL INSTRUMENTATION

Course Code: EI46

Credit: 4:0:0

Prerequisite: Engineering Physics (PY12)

Contact Hours: 56

Course Coordinators: Mr. M. D. Nandeesh and Dr. Christina Grace

Course Content:

Unit I

Visible, ultraviolet and IR spectrophotometers: Introduction, Chemical analysis, Instrumental methods advantages over classical methods, classification, various units used in chemical analysis, Electromagnetic radiation, Beer Lambert law, absorption instruments, colorimeters, spectrophotometers, UV, visible and IR instrument components, FTIR, photo-colorimeters, single and double beam instruments.

Unit II

Spectrometric Methods: Atomic absorption and Emission Spectroscopy: Principle, types, Flame photometer, DC arc and AC arc excitation, plasma excitation. X-ray spectrometer- Principles, instruments, Fluorescence, absorption, diffraction, auger emission spectrometer. Application of spectroscopy in air quality monitoring.

Unit III

Separative Methods: Mass Spectrometer (MS): Principle, ionization methods, mass analyzer types - magnetic deflection type, time of flight, quadrupole, double focusing, detectors, Chromatography: Classification, Gas chromatography: principle, constructional details, GC detectors, High Performance Liquid Chromatography (HPLC): principle, constructional details and detectors

Unit IV

Principles and applications of lasers: Emission and absorption of radiation, population inversion, optical feedback, laser modes and classes of lasers-Nd-YAG, ruby, HeNe laser and argon laser, application in medical fields. Single mode operation, frequency stabilization, line shaping function, mode locking, Q switching, measurement of distance and holography

Unit V

Microscopy and techniques: Fundamentals of optics, Optical microscopy, Dark field & fluorescence microscopy, Scanning electron microscopy -Instrumental details, Sample preparation, Transmission electron microscopy, Scanning probe microscopy, Scanning tunneling microscopy, Atomic force microscopy, Applications.

Text Books

1. Principles of instrument analysis – Skoog, Holler and Nieman, 4th edition 2006, Thomson publication
2. Lasers and optical instrumentation- S Nagabhushana, N Sathyanarayana – I K International Publishing House Pvt. Ltd.
3. Jeffery C. Pommerville. Alcamo's Fundamentals of Microbiology (Tenth Edition). Jones and Bartlett Student edition.

References

1. Instrumental methods of analysis by H. H. Willard, L. L. Merritt & J. A. Dean, CBS Publications 7th Ed 1988
2. Instrumental Methods of chemical analysis- H Kaur- Pragathi Edition
3. Optoelectronics an introduction- J Wilson and J F B Hawkes 2nd edition, Prentice-Hall (2001).

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply the knowledge of optics to describe optical instrument for chemical analysis (PO1,2,4,7 PSO1,2)
2. Explain the working principles of various types of analytical instruments (PO1,2,4 PSO1,2)
3. Describe the principles of different chromatographic and spectroscopic techniques (PO1,2,4 PSO1,2)
4. Illustrate the necessity and working of different components used in laser based optical instruments (PO1,2,4,PSO1,2)
5. Analyze the sampling techniques of various application of analytical instruments used for environmental monitoring (PO1,2,6,7 PSO1,2)

EMBEDDED CONTROLLERS LAB

Course Code: EIL47

Credit: 0:0:1

Prerequisite: Nil

Contact Hours: 14

Course Coordinator: Ms. Elavaar Kuzhali S.

List of experiments

Part A: Assembly language programs

- Swap two numbers without using an intermediate register
 - To find the factorial of a given number
 - Convert word of little endian format to big endian format.
- Generate 12 bit Hamming code from a given 8 bit code
- Move a string from given memory location to another location
 - To Add N numbers of data stored consecutively in memory location
 - Translate the given C code to assembly, for $(i=0;i<8;i++)\{a[i]=b[7-i];\}$.
- Move a block of data from memory location to another location using LOAD multiple and STORE multiple instructions.
 - Exchange a block of data between memory locations.
- Arrange a given set of data in ascending order
 - Arrange a given set of data in descending order
- Implement subroutine nesting using stack
 - To implement ARM –THUMB interworking to find the smallest.
 - To handle swi instruction in the program

Part B: C Programs

- To familiarize I/O ports of LPC 2148 - on/off control of LEDs using switches
- To display a given string using the LCD display interface
- Interface key pad and to display the key pressed on LCD
- Waveform generation using the internal DAC of LPC 2148.
- To convert a given analog voltage to digital using ADC of LPC 2148.
- Using timers to generate a specified delay
- Using timer/counter/capture module of LPC 2148 to count the number of pulses and display on LCD.
- Use of UART of LPC 2148 for transmitting and receiving data

Course Outcomes (COs):

At the end of the course, students will be able to

1. Design, implement, and debug ARM/THUMB assembly level programs using Keil software. (PO-1,2,3,4,5,9,10,12, PSO-1,3)
2. Design, develop, and analyze and debug embedded C programs to interact with Built in Peripherals (GPIO's, DAC, ADC, Timer/Counter, and UART) of ARM7 LPC 2418. (PO-1,2,3,4,5,9,10,12, PSO-1,3)
3. Write programs to handle exceptions and interrupts in ARM processor. (PO-1,2,3,4,5,9,10,12, PSO-1,3)

INDUSTRIAL INSTRUMENTATION LAB

Course Code: EIL48

Credit: 0:0:1

Prerequisite: Nil

Contact Hours: 14

Course Coordinator: Dr. H. S. Niranjana Murthy

List of experiments

1. Displacement measurement using Potentiometer.
2. Displacement measurement using LVDT.
3. Strain gauge load cell.
4. Linear and Angular displacement using capacitive transducer.
5. Absorbance measurement using optical sensors.
6. Pressure transmitter/ transducer -calibration.
7. Rough vacuum measurement using vacuum pressure transducer.
8. Temperature measurement using RTD.
9. Temperature measurement using Thermistor.
10. Temperature measurement using Thermocouple.
11. Temperature measurement using AD590.
12. Temperature measurement using IR sensor.
13. Displacement, Velocity and Acceleration measurement using Vibration sensor.
14. Strain measurement using Cantilever beam.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Use appropriate sensors and measure temperature, displacement, strain and pressure. (PO-1,2,3,9,10, PSO-1,3)
2. Calibrate measuring instruments based on available standards. (PO-1,2,3,9,10, PSO-1,3)
3. Plot the response of the instruments and compare with the ideal/ theoretical response. (PO-1,2,3,9,10, PSO-1,3)