SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Instrumentation Engineering

SEMESTER -V

Linear Control Systems
EIA-501

EIA-501	Linear Control Systems	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preambles:

1. To develop basic skills of utilizing mathematical tools needed to analyze and design classical
   linear control systems.
2. To understand and develop the state space representation of control systems.

Course Outcomes:

1. Understand the concept of the terms control systems, feedback, Mathematical modeling of Electrical and Mechanical systems.
2. Explain the time domain and frequency response analysis of control systems.
3. Acquire the knowledge of various analytical techniques used to determine the stability of control systems.
4. Able to understand the importance of design of compensators
5. Able to demonstrate controllability and observability of modern control systems.

UNIT-I (10H)

Introduction to Control Systems: Classification of control systems. Components of control systems, Feed-Back Characteristics, Effects of feedback - Mathematical modeling of Electrical and Mechanical systems, Transfer function, Transfer function of Potentiometer, synchro, AC servo motor, DC servo motor, Block diagram reduction technique, Signal flow graph, Mason's gain formula

UNIT-II (10H)

Time Domain Analysis: Standard test signals, Time response of first order systems, Transient response of second order system for unit step input, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of P, PD, Pl and PID controllers.

UNIT-III (10H)

Stability Analysis in S-Domain: The concept of stability, Routh's stability Criterion, Absolute stability and relative stability, limitations of Routh's stability.
Root Locus Technique: The root locus concept, construction of root loci, Effects of adding poles and zeros on the root loci.

UNIT-IV(6H)

Frequency Response Analysis: Introduction to frequency response, Frequency domain specifications, Bode plot, Stability analysis from Bode plots, Determination of transfer function from the Bode Diagram, Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin

Control System Design: Introduction - Lag, Lead and Lag-Lead Compensator design in frequency Domain

UNIT-V (6H)

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models, State transition matrix, Solution of state equation, Concepts of Controllability and Observability.

Reference Book:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.
2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008.

EIA-501	Linear Control Systems	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

LIST OF EXPERIMENTS

1. Characteristics of DC Servomotor.

2. AC Position control system.

3. DC Position control system.

4. ON/OFF Temperature Control system.

5. Step response of second order system.

6. Characteristics of AC Servomotor.

7. Characteristics of synchro pair .

8. Frequency response analysis of LEAD compensating network

9. Frequency response analysis of LAG compensating network

10. Temperature control system using PID.

11. Level control system.

12. Step response and frequency response of a given plant

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Digital Signal Processing
EIA-502

EIA-502	**Digital Signal Processing**	**2L:1T:0P**	**3 Credits**	**3Hrs/Week**

Course Preambles:
The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems**.**

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

Unit-I(10H)
Introduction to Digital Signal Processing, Discrete time signals & systems, linear shift invariant systems, stability and causality, Linear-constant coefficient difference equations, Frequency domain representation of discrete time signals and systems, properties of the Discrete Time Fourier transform (DTFT), Sampling and discrete time processing of continuous-time signals.

Unit-II(10H)
Applications of z-transforms, solution of difference equations of digital filters, System function, stability criterion, frequency response of stable systems, one sided Z-transform and its applications.

Unit-III(10H)
Discrete Fourier series: Properties of discrete Fourier series, DFS representation of periodic sequences. Discrete

Fourier Transforms: Properties of DFT: Fast Fourier Transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms. Inverse FFT.

Unit-IV (6H)
IIR DIGITAL FILTERS: Analog filter approximations - Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Bilinear transformation method, step & impulse invariance

techniques, Spectral Transformations, Realization of IIR digital filters - direct, canonic, cascade & parallel forms.

Unit-V(6H)

FIR DIGITAL FILTERS: Characteristics of FIR Digital Filters frequency response, Design of FIR Digital Filters using Window Techniques. Comparison of IIR and FIR filters, Realization of FIR digital filters direct, linear phase, cascade & parallel forms.

Text/Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH

2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.

4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.

6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

EIA-502	**Digital Signal Processing**	**0L:0T:2P**	**1 Credits**	**2Hrs/Week**

List of Experiments (Extendable)

1. Generation, analysis and plots of discrete-time signals.

2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding

3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.

4. Computation and plots of z-transforms, verification of properties of z-transforms.

5. Computation and plot of DFT of sequences, verification of properties of DFT.

6. Implementation of various window design techniques (Rectangular, Bartlett, Hamming)

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EIA-503
CMOS Design

EIA-503	CMOS Design	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:

1. To learn basic CMOS Circuits.
2. To learn CMOS process technology.
3. To learn techniques of chip design using programmable devices.
4. To learn the concepts of designing VLSI Subsystems.

Course Outcomes:
At the end of the course the students will be able to
1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

UNIT-I(6H)

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor.

UNIT-II (10H)

Transistor as a switch. Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts.

UNIT-III (6H)
Power, interconnect and Robustness in CMOS circuit layout.

UNIT-IV (10H)
Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic.

UNIT-V (10H)
Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.

'Text/Reference Books:
1.N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, 2011.
2. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

List of Experiments:

1. Design Universal gates and all other gates using S-edit and getting its transient response
2. Obtain the DC- characteristics of CMOS Inverter using DC-analysis.
3. Design Symbol of CMOS Inverter and using instances of its getting transient response.
4. Design Symbol of Universal gates and using instances of them getting transient response.
5. Design a Transmission gate using PMOS & NMOS by instance calling.
6. Design the Layout of NMOS and PMOS transistor.
7. Design the Layout of CMOS Inverter.

EIA-503	**CMOS Design**	**0L:0T:2P**	**1 Credits**	**2Hrs/Week**

LIST OF EXPERIMENTS

1 . Familiarization with MOS model parameters in PSPICE software.
2 . Simulation of MOS Inverter with different loadsusing PSPICE software.
3 .Simulation of CMOS Inverter for different parameters *Kn, Kp* as a design variablein PSPICE software.
4. Study of the switching characteristics of CMOS Inverter and find out noise margins.
5. Simulate CMOS amplifier using PSPICE software.

6. Layout design of a CMOS Inverter using any layout design tool.

Layout design of a 2-input CMOS NAND/NOR gate using any layout design tool

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Program Elective-I
EIA-504(A) Power Electronics

EIA-503(A)	**Power Electronics**	**3L:1T:0P**	**4 Credits**	**4Hrs/Week**

Course Preambles:

1.To understand and acquire knowledge about various power semiconductor devices.

2.To prepare the students to analyze and design different power converter circuits.

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

UNIT-I (10H)

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBTTreatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

UNIT-II (10H)

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

UNIT-III (10H)

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper.

UNIT-IV (6H)

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

UNIT-V (6H)

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter – series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

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EIA-504(B)
Instrumentation Systems

EIA-503(B)	**Instrumentation Systems**	**3L:1T:0P**	**4 Credits**	**4Hrs/Week**

Course Preambles:

1. To expose the students to various sensors and transducers for measuring mechanical quantities.
2. To understand the specifications of sensors and transducers.
3. To learn the basic conditioning circuits for various sensors and transducers.
4. To introduce advances in sensor technology.

Course Outcomes:

1. Familiar with both static and dynamic characteristics of measurement system.
2. Familiar with the principle and working of various sensors and transducers.
3. Able to design signal conditioning circuit for various transducers.
4. Able to identify or choose a transducer for a specific measurement application

UNIT –I (10H)

Measurement of Motion: Angular velocity (speed) measurement: Electrical methods like DC and AC Tacho generators, eddy current (drag cup) Tachometers and Stroboscopic method. **Acceleration measurements**: Seismic displacement, velocity, acceleration pick-ups, electromagnetic and electro dynamic type of velocity transducers, piezoelectric transducers, deflection type of accelerometer, bonded strain gauge accelerometer, and piezoelectric accelerometers.

UNIT-II (10H)
Measurement of force, Torque and Temperature: Basic methods of force measurement: characteristics of elastic force transducers, load cells. **Various types of Torque measurement**: absorption, transmission, stress, deflection type. **Measurement of Temperature:** Laws of thermocouples, Thermocouple circuits, reference junction considerations ice bath reference junction special materials, configurations and techniques (cooled thermocouples, pulsed thermocouples, and multifunction thermocouples) and radiation thermometers.

UNIT – III (10H)

Measurement of flow: Classification of flow meters, head flow meters like orifice plate, venture tube, flow nozzle and pitot tube. Rotameter, electromagnetic flow meter, positive displacement meter, hot wire and hot film anemometer, mass flow measurements, rotor torque mass flow meter.

UNIT-IV (6H)

Measurement of liquid level: Electrical methods: Resistive, inductive and capacitive methods, capacitive variable area method, capacitive voltage divider method, capacitive variable dielectric constant method. Measurement of liquid level using gamma rays, ultrasonic method and float
Measurement of humidity: Absolute Humidity, relative humidity, hygrometers (resistive and capacitive hygrometer), Microwave refractometer , Aluminum oxide hygrometers.
Measurement of PH Electrodes: Station Glass and Calomel Electrodes, installation of PH meters.

UNIT V (6H)
Measurement of sound: Sound level meter microphones with their types like carbon and capacitive microphone, dynamic microphone, inductive microphone, piezo electric microphone. Pressure response of capacitive microphone

Referance Book:

1. C.S.Rangan, G R Sarma & V S N Mani, Instrumentation Devices and Systems-TMH, 2nd Edition 2004

2.B.Nakra & Chowdhari, Instrumentation Measurement and Analysis, TMH, 2nd Edition

3. D.V.S.Murthy, Transducers and Instrumentation. PHI, 1995 4. John P. Bentley, Principles

of Measurement Systems, 3rd Edition, Pearson Education, 2000.

4. Doebelin E.O, Measurement Systems - Application and Design, 4th Edition, McGraw-Hill .

5. Patranabis D, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill, New Delhi, 1997.

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Open Core Elective - I
EIA-505(A)
Data Compression & Cryptography

EIA-505(A)	**Data Compression & Cryptography**	**3L:1T:0P**	**4 Credits**	**4 Hrs/Week**

Course Preambles:
This course will cover the concept of security , types of attack experienced, encryption and authentication for deal with attacks, what is data compression, need and techniques of data compression

Course Outcomes
At the end of this course the student will have the knowledge of Plaintext, cipher text, RSA and other cryptographic algorithm, Key Distribution, Communication Model, Various models for data compression

Unit-I (10H)
Introduction to the Concept of Security: Introduction, The Need of Security, Security Approaches, Principal of Security, Types of Attacks.

Unit- II (10H)
Cryptographic Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks .

Unit-III (10H)
Computer-based Symmetric Key Cryptographic Algorithms: Introduction, Algorithm Types and Models, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC5, Blowfish, Advanced Encryption Standard(AES), Differential and Linear Cryptanalysis.

Unit- IV (6H)
Computer-based Asymmetric Key Cryptographic Algorithms: Introduction, Brief History of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some other Algorithms.

Unit- V (6H)
Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography standard(PKCS), XML, PKI and Security .

References: 1.Behrouz A. Forouzan and D. Mukhopadhyay- Cryptography & Network Security, 2nd Edition - 1 st reprint 2010, McGraw Hill, New Delhi.
2.WadeTrapple, Lawrence C. Washington- Introduction to Cryptography with coding Theory, 2nd Edition pearson Educat

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EIA-505(B) Advanced Sensors
EIA-505(B)

EIA-505(B)	**Advanced Sensors**	**3L:1T:0P**	**4 Credits**	**4 Hrs/Week**

Course Preambles:

1. To introduce the principles of Advanced sensors
2. To introduce the construction and applications of Advanced sensors

Course Outcomes

1. Develop an understanding of need multi sensor and recent trends in technology
2. Explore Smart sensors working principle
3. Discuss the techniques for MEMS, NANO and Chemical sensors techniques
4. To understand the basic operation involved in Robotics, fiber optics and Boi sensors

UNIT – I

Sensor Fundamentals: Basic sensor technology and sensor system. **Application Consideration**: Sensor characteristics, system characteristics, instrument selection, data acquisition and readout, and installation.

UNIT –II

Biosensors: Overview, applications and of origin of biosensor, bio receptor molecules, transduction mechanisms in biosensors, application range of biosensors, and future prospects. **MEMS and NANO sensors:** Micro electromechanical systems (MEMS), Micromachining, Biomedical Applications, NANO sensors and carbon NANO tubes.

UNIT – III

Smart Sensors: Technology fundamentals and applications. **Electromagnetism in sensing**: Introduction to electromagnetism and inductance in sensor application, magnetic field sensors and applications.

UNIT – IV

Chemical Sensors: Introduction to semiconductor gas detectors, ion selective electrodes, Conduct metric sensors, and mass sensors. **Fiber optic sensors:** Fiber optic sensors for the measurement of temperature, pressure, displacement, turbidity and pollution.

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UNIT – V

Robotics sensors: Introduction, characteristics and types of sensors, touch or tactile sensors, binary and analog sensors, proximity sensors, types of proximity sensors, contact and non-contact proximity sensors, robotic vision.

1. Sensor Technology Handbook by Jon Wilson Newness Publication Elsevier
2. Pallas-Areny R and Webster JG, "Sensors and Signal Conditioning," Wiley India
3. Gardener, "Micro sensors, MEMS and Smart Devices," Wiley India
4. Khazan AD, "Transducers and their Elements – Design and Applications," Prentice Hall
5. Patranabis D, "Sensors and Transducers," Prentice Hall
6. Middlehook S and Audet SA, "Silicon Sensors," Academic Press
7. Dorf RC, "Sensors, Nanoscience, Biomedical engineering and instruments," CRC Press
8. Zanger H and Zanger C, "Fiber optics Communication and other applications," Macmillan publishing
9. Joshi RM, "Biosensors," ISHA Books
10. Webster JG, "Medical Instrumentation, Application and Design," Wiley India

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Industrial Training-I
EIA-506

EIA-506	**Industrial Training-I**	**0L:0T:4P**	**2 credits**	**4Hrs/Week**

Course Preamble:

1. To expose the students to actual working environment **Electronics & Instrumentation** engineering and enhance their knowledge and skill from what they have learned in the classes.
2. Another purpose of this program is to instill the good qualities of integrity, responsibility and self-confidence.
3. To persue students with the electrical field ethics and rules in terms of the society.

Course Outcomes:

Ability to communicate efficiently. Acquired to be a multi-skilled engineer with good technical knowledge of electrical and electronics components and their processing, management, leadership and entrepreneurship skills. Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Students must observe following points to enrich their learning in electrical engineering during industrial training:

- Industrial environment and work culture.
- Organizational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Roles and responsibilities of different categories of personnel.
- Customer services.
-Problems related to various areas of Work etc.
- Layout if any

To be submitted : The students has to submit the power point presentation of minimum15 slides of the training performed(comprising of points stated above) along with the original certificate of training performed with proper seal and signature of the authorized person.

Scheme of Studies:

Duration: Minimum 2 weeks in summer break after IV semester, assessment to be done in V Semester

Scheme of Examination:

For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry Marks Allotted

Attendance and General Discipline 20
Daily diary Maintenance 20
Initiative and participative attitude during training 30
Assessment of training by Industrial Supervisor 30

Total 100*

(b) Practical/Oral Examination (Viva-Voce) in Institution Marks Allotted
1. Training Report 50
2. Seminar and cross questioning (defense) 100

Total 150

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* - Marks of various components in industry should be awarded by the I/c of training in Industry but in special circumstances if not awarded by the industry then faculty in charge /T.P.O. will give the marks.

During training students will prepare a first draft of training report in consultation with section In charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.