

Control System Components [CSC]

T.E. Sem.V [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical and Oral Exam	–	–
Oral Exam		25
Term Work	–	25

SYLLABUS

1. Pneumatics

Pneumatic System Components : ISO symbols, pneumatic air supply system, Air compressors, Pressure regulation devices, Directional control valves and special types of pneumatic valve such as Pilot-operated valves, Non-return valves, Flow control valves, Sequence valves, and Time delay valve.

Linear actuators : Single-acting, Double-acting, and special type of double-acting cylinder.

Rotary actuators : Air motors.

Process Control Pneumatics : Flapper Nozzle system, Volume boosters, Air relays, Pneumatic transmitters and controllers, Pneumatics logic gates, dynamic modeling of pneumatic circuits.

2. Hydraulics

Hydraulic System Components : Hydraulic pumps, Pressure regulation method, Loading valves. Hydraulic valves and actuators. Speed control circuits for hydraulic actuators. Selection and comparison of pneumatic, hydraulic and electric systems.

3. Transmitters

Electronic versus pneumatic transmitters, 2-wire; 3-wire and 4-wire current transmitters, Electronic type-temperature; pressure; differential pressure; level; flow transmitters and their applications, Smart (Intelligent) transmitters, Buoyancy transmitters and their applications. Converters - Pneumatic to Electrical and Electrical to Pneumatic converters.

4. Process Control Valves

Control valve terminology, Types- Globe, Ball, Needle, Butterfly, Diaphragm, Pinch, Solenoid, Smart control valves, and special designs of Globe valves. Flow characteristics, Control valve parameters-control valve capacity; valve rangeability and turn-down; valve size; and valve gain, Selection criteria. Specification and Installation of control valves.

Valve Positioners : necessity, types-motion balance and force-balance, and effect on performance of control valve.

Control Valve Actuators : Electrical, Pneumatic, Hydraulic, Electro-mechanical, and Digital actuators. Selection criteria of valve actuators.

5. Auxiliary Process Control Components

Alarm annunciators, Square root extractor, Feeders, Dampers, Temperature regulator, Flow regulator, Temperature switch, Flow switch, Level switch, Pressure Switch, Relief valves, safety valves and rupture disk. Thermostats and Humidistat.

6. Industrial Motor Control Components

Switches : Construction, symbolic representation, working, application of Toggle switches, Push buttons, Selector switches. DIP switches, Rotary switches, Thumbwheel switches, Drum switch, Limit switches-contact, non-contact-type, Switch specifications.

Control Relays : Construction, working, specifications, selection criteria and applications of Electro-mechanical relay, Reed relay, hermetically sealed relay, Solid state relays, Interposing relays and Overload relays.

Contactors/starters : Construction, working, specifications and applications of starters and contactors. Comparison between relays and starters / contactors.

Timers : On delay timers; Off delay; and retentive timers.

Auxiliary output devices : Pilot Lights, Horns, Solenoids, Heaters and stepper motors.

Development of relay ladder and wiring diagrams for motor control applications using above components.

References :

1. Process Control and Optimization (*Bella G. Liptak*) Instrument Engineer's Handbook, 4th Edition, CRC Press.
2. Applied Instrumentation in the process Industries (*WG Andrews and Williams*) Vol. I and II, Gulf Publication.
3. Hydraulics and Pneumatics – A technician's and engineer's guide (*Andrew Parr*) A technician's and engineer's guide, Jaico Publishing House, Mumbai.
4. Pneumatics, Festo Didactic.
5. Hydraulics, Festo Didactic.
6. Process Control and Instrument Technology (*C. D. Johnson*) TMH.
7. Process Control (*P. Harriot*) Tata McGraw Hill, 2001.
8. Control Valve Selection and Sizing (*Less Driskell*) ISA.
9. ISA Handbook of Control Valves (*J. W. Hatchison*) 2nd Edition, ISA, 1990.
10. Instrument Technology (*E. B. Jones*) vol-III, Butterworth Publication.
11. Automatic Process Control (*D. P. Ekman*) Eastern, 1990.
12. Industrial Electronics (*Thomas E. Kisell*) 3rd Edition, PHI.



Signal Conditioning Circuit Design [SCCD]

T.E. Sem.V [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	2 Hrs.	25
Oral Exam		25*
Term Work	–	25

* – Oral examination will be based on a mini-project.

SYLLABUS

1. Components of Analog Signal Conditioning

Signal level and bias changes, linearization, conversion, filtering and impedance matching, concept of loading. Passive signal conditioners- voltage divider, Wheatstone bridge circuits (Current, Voltage, Balanced and Unbalanced), RC filters, and Active signal conditioners- op-amp based circuits, Standard Signals (Analog)

2. Operational Amplifier

Ideal and practical op-amp, Differential Amplifier- a.c. and d.c. analysis, improving voltage gain using active load etc, current sources, unbalanced op-amp frequency response and stabilizing unbalanced operation, circuit diagram of IC741 and working in detail, a.c. and d.c. characteristics, specifications, measurement of op-amp parameters.

3. Operational Amplifier Circuits in Instrumentation

Voltage follower, inverting and non-inverting Amplifier, Adder, Subtractor, Differential Amplifier, Instrumentation Amplifier, V to I and I to V converter with floating load and grounded load, Integrator, differentiator and compensated differentiator, Precision rectifier- half wave, full wave, absolute value circuits, clipping, clamping circuits, practical clamping circuits, sample and hold circuits, peak detectors, log amplifiers, temperature compensated log amplifier, antilog amp., multiplier, divider, comparator, threshold detector, Schmitt trigger, free running multivibrator, Wien-bridge oscillator, Phase shift oscillator, Active filters, Astable, Monostable, and Bistable multivibrators, Norton amplifier, Pulse, Triangle and Sine wave generator, PLL.

4. Components of Digital Signal Conditioning

Converters – ADC, DAC, V to F (LM331 and 555 Timer) and F to V – Types and Structure, conversion, resolution and other characteristics. Characteristics of digital data- digitized value, sampled data system and linearization. Standard signals (Digital). Data acquisition system hardware, Data Logger.

5. Transducer Signal Conditioning Design

Thermal sensor conditioning – design considerations and applications for RTD, Thermistor, thermocouple and solid state temperature sensors.

Optical sensor conditioning- photoconductor, photovoltaic, photodiode, phototransistor, and photomultiplier tube, Optical encoder conditioning for linear displacement, linear velocity and angular displacement application.

Other Sensors conditioning – Potentiometer, LVDT, strain gages, piezoelectric transducers and capacitive transducers.

6. Power Supply Design

Power Supply design using 78xx series, 79xx series and adjustable IC regulator 723/317. Switch mode Power Supply (SMPS) Block Diagram with advantages and disadvantages over conventional power supply.

References :

1. Op-Amp & Linear ICs (*Ramakant Gaikwad*) PHI Pearson Education.
2. Process Control Instrumentation Technology (*C. D. Johnson*) VIIIth Ed.
3. Op-amp and linear ICs (*Coughlin & Driscoll*) 6th edition. PHI, 2002.
4. Transducer Interfacing- signal conditioning for process control (*Robert G. Seippel*) Prentice Hall.
5. Microprocessor Based Process Control (*C. D. Johnson*) PH.
6. Design with op-amp analog ICs (*Sergio Franco*) McGraw Hill, 1988.
7. Linear Integrated Circuits (*Roy Choudhary*) Wiley Eastern, 1991.
8. Burr-Brown General Catalog (*Tucson*) Ariz: Burr-Brown, 1979.
9. Intersil Data Acquisition Component Handbook (*Datel*) Datel – Intersil, Inc, 1980.
10. Linear and Interface Circuits Applications (*D. E. Pippengre and E. J. Tobanen*) 2nd Edition, McGraw Hill Book Company, 1988.



Signals and Systems [S&S]

T.E. Sem.V [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Introduction

- Definition of signal, Basic signals in continuous time and discrete time domain. Basic operation on continuous and Discrete signal.
- Singular Functions: Ramp, step and Impulse functions, Axiomatic, Definition of impulse function, approx. to impulse function and the generalized impulse function.
- Classification of signals: Periodic/ non-periodic, Even/Odd, Deterministic/ Stochastic and Energy/ Power signals.
- Representation of a system as a mapping between input and output signals, System as a means of transformation of signals.
- System representation in continuous and discrete time domain in terms of differential and difference equation respectively. Normal form representation of signals.
- Block diagram of continuous and Discrete time system, Classification of systems: Causal / Non-causal, time-varying, time-invariant, stable / unstable, invertible / non-invertible and lumped/distributed parameter systems.

2. Linear Time Invariant System :

Continuous Time LTI system: Linear differential equations. Representation of signals by a continuum of impulses, system impulse response and the convolution integral. Evaluation and Interpretation of Convolution Integral.

Discrete Time LTI system: Convolution sum (linear and Circular convolution). Properties of LTI system.

3. Laplace Transform :

Definition and its Properties, Inverse Laplace, Transient and steady state response of LTI system, Stability of system.

4. Z-Transform :

Definition, Convergence, properties and inversion of Z-Transform. Concept of single and double sided Laplace Transform. Analysis of discrete time system using Z-Transform. Relationship between Laplace and Z-Transform, Fourier transforms.

5. Continuous and Discrete Time Fourier Series :

Orthogonal functions: Definitions, approximations, coefficient calculation on the basis of minimum mean square error.

Fourier series: representation of Fourier series in terms of trigonometric, exponential functions. The complex Fourier spectrum. Properties of Fourier series. Convergence of Fourier series. Gibb's phenomenon.

6. Continuous and Discrete Time Fourier Transform :

Continuous and Discrete time Fourier transform and its properties.

References :

1. Signals and Systems (*Oppenheim, Wilsky and Nawab*) PHI / Pearson Education, 2nd edition, 2002.
2. Signals and Systems (*S. P. Xavier*) 2nd Edition, S. Chand and Co., 1998.
3. Signals and Systems (*J. B. Gurung*) 1st Edition, PHI, 2009.
4. Signals Processing (*Reddy and Prasad*) TMH, Vol. II 1994.
5. Principles of Signals and Systems (*Taylor*) McGraw Hill, 1994.
6. Signals and Systems (*Haykin, Simon S.*) John Wiley, New York, 1978.
7. Signals Processing and Linear Systems (*Lathi B. P.*) Oxford University Press, 2003.
8. Signals and Systems (*I. J. Nagrath*) 1st Edition, TMH, 2000.
9. Introduction to Signals and Systems (*Douglas K. Lindner*) TMH, 1999.
10. Signals and Systems – Continuous and Discrete (*Rodger E. Ziemer, William H. Tranter*) Pearson Education, 4th Edition, 2002.



Microprocessors and Applications [MPA]

T.E. Sem.V [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical and Oral Exam	2 Hrs.	25
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Introduction

Microprocessor definition, operation of ALU, Van Numan, Haward architecture, evolution of microprocessors, block diagram of microprocessor based system and development cycle, Machine language, Assembly language, high level language, assembler, compilers.

2. 8085 Microprocessors and Memory Interfacing

8085 architecture and its functional blocks, 8085 microprocessor IC pin outs and signals, demultiplexing address and data bus, generation of control signals, machine cycles and timing diagram of instruction. Memory interfacing.

3. Programming of 8085 Microprocessor

Programming model of 8085. Instruction set of 8085, addressing modes, writing assembly language programs, looping, counting, and indexing operations, BCD arithmetic, stack and subroutines, Conditional call and return instructions.

4. Interfacing

Basic interfacing concepts, interfacing input and output devices, memory mapped input and input mapped input.

8155 Interfacing and programming,

8255 Interfacing and programming,

Keyboard and display Interfacing and programming

ADC (0801/0808) and DAC (DAC 0808/DAC 0809) Interfacing and programming.

5. Interrupt, DMA, and Serial Communication

Interrupt structure of 8085, RST instruction, vectored interrupts, interrupt process, 8259 interrupt controller.

Data transfer techniques, 8257 DMA controller.

Serial input lines of 8085 and implementation asynchronous serial data communication using SID, SOD lines.

6. Instrumentation Applications

Multi-channel Data Acquisition System (Minimum 4 channel with input modules of Pressure, voltage, current, temperature etc). Generation of different signals using DAC.

DC drives using h bridge.

Temperature Control application,

Stepper motor control.

7. Advanced Processors

Architecture and organization of 8086, bus interface unit, operation of queue, 8086 hardware pin signals, timing diagram of 8086 family microprocessor, minimum and maximum mode, memory organization and addressing modes. Pipelining, super-scalar execution concept.

References :

1. Microprocessor, Architecture, Programming and Application with 8085, (*R.S. Gaonkar*) Penram International Publishing (India) Pvt. Ltd. Fifth Edition.
2. The 8085 Basic, Programming and Interfacing (*Prof. U.V. Kulkarni, Dr.T.R. Sontakke*) SadhuSudha Prakashan.
3. Microprocessor and Interfacing (*Douglas V. Hall*) Tata McGraw–Hill Publishing Co. Ltd. 2nd edition.
4. The 8085 Microprocessor : Architecture, Programming & Interfacing (*Udaykumar*) Pearson Education.
5. Microprocessors & Peripherals (*Chowdhury*) et.al. SciTech Publications (India) Pvt. Ltd. Chennai.



Communications Systems [CS]

T.E. Sem.V [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical and Oral Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Introduction to Communications Systems

Elements of a communication system, noise in communication systems, introduction to radio wave propagation.

2. Amplitude Modulation

Introduction, time and frequency domain analysis, power relations, basic requirements and description and description of various modulators, comparison of DSB, SSB, VSB, spectrum modulator and detectors.

3. Angle Modulation

Introduction, frequency modulation, phase modulation, spectrum of FM, effect of noise in FM, generation of FM, detection of FM.

4. Transmitters and Receivers

Introduction, transmitters-requirements, topologies, AM and FM transmitters, receiver – topologies, characteristics, variations, measurements, transceivers, characteristics and block diagram of broadcast radio transmitters.

5. Pulse and Digital Modulation

Pulse modulation methods, pulse amplitude (PAM), pulse position (PPM), pulse duration/width (PDM/PWM).

Modulation methods for digital signals over analogue: amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK), Quaternary Phase Shift Keying (QPSK), Quaternary Amplitude Modulation (QAM) Digital modulation methods: Pulse Code Modulation (PCM); Delta modulation; Adaptive Delta modulation,

Multiplexing techniques: space division; frequency division; time division; wavelength division.

6. Telemetry

Methods of data transmission, general telemetry system, types of telemetering systems – land line telemetering, RF telemetering, voltage telemetering system, current telemetering system, force balance telemetering, impulse and position telemetering system, land line telemetry feedback systems, FM telemetry systems, PAM telemetry, PCM telemetry.

References :

1. Electronic Communication Systems, 2nd Edition (*Blake*) Thomson Learning, 1989.
2. Communication Systems (*Haykin, Simon S.*) John Wiley, New York, 1978.
3. Principles of Communication Engineering, 2nd Edition (*Taub & Schilling*) McGraw –Hill, 1993.
4. Communication Systems 2nd Edition, (*Bruce Carlson*) McGraw Hill, 1994.
5. Electronic Communication Systems, (*Kennedy & Davis*) McGraw Hill, 1985.
6. Signals, Systems and Communications (*Lathi Ghagwandas Pannalal*) John Wiley, New York, 2000.
7. Electronic Communications, 3rd Edition (*Dennis Roddy and John Coolen*) Prentice Hall of India (P) Ltd., New Delhi, 1986.
8. A course in Electrical and Electronic Measurements and Instrumentation (*A.K. Sawhney*) Dhanpat Rai and Co., 1997.
9. Telemetry Systems (*Perry A. Borden and W.J. Mayo*) Wells Reinhold publishing corporation, New York, 1959.
10. Electronic Communication Systems (*William Schweber*) PHI, 4th Edition, 2002.

