SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

M. Sc. (INSTRUMENTATION) – THIRD SEMESTER
Syllabus Effective from Academic year June 2018-19]

PS03CINC21: BIOMEDICAL INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Medical Instrumentation System, Constraints in Design of Medical Instrumentation System, Origin of Bioelectric Signals, Recording Electrodes, Electrocardiograph (ECG), Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyograph (EMG)

Biofeedback Instrumentation, Beside Patient Monitoring Systems, Heart Rate Meters, Measurement of Pulse Rate, Blood Pressure Measurement

Arrhythmia Monitor, Ambulatory Monitoring Instruments, Methods of Monitoring Foetal Heart Rate, Monitoring Labour Activity, Telemetry System, , Implantable Telemetry System for Blood Pressure & Blood Flow

Oximeters, Types of Blood Flow Meters, Spirometry Types, Pulmonary Function Analyzer, Measurement of Blood pH, pCO_2, pO_2, Complete Blood-Gas Analyzer, Audiometer, Patient Safety**:** Effect of Electric Current on Human Body, Types of Leakage Current, Precautions to minimize Electric Shock Hazard, Testing of Biomedical Equipment

BOOKS:

1. *Handbook of Biomedical Instrumentation,* II-Edition, R. S. Khandpur, Tata McGraw-Hill.

2. *Biomedical Instrumentation and Measurements,* Leslie Cromwell, Fred J. Weibell & Erich A. Pfeiffer, Prentice Hall of India.

3. *Introduction to Biomedical Instrumentation and Measurement Technology*, Carr, Brown, Pearson Education.

4. *Medical Instrumentation Application and Design,* III-Edition, John G. Webster-Editor, John Wiley & Sons, INC.

5. *Biomedical Transducers and Instruments,* Tatsuo Togawa, Toshiyo Tamura & P. Ake Oberg, CRC Press.

M. Sc. (INSTRUMENTATION & CONTROL) – THIRD SEMESTER
PS03CINC22: INDUSTRIAL COMMUNICATION TECHNIQUES
Total Marks:100 (External – 70, Internal – 30)

Data Communication**,** Data Transmission & Modes, Digital Signal Encoding, Unipolar, Bipolar Line Codes, Data Compression Techniques, Error Detection & Correction Methods, Digital Modulation Methods

Data Multiplexers**:** TDM, FDM, Interface Standards: RS 232, RS 422, RS 423, RS 485, IEE 488 (GPIB), HART, Repeater, Hub, Router, Gateway

Open System Interconnection**:** Layered Architecture, Functionality, Local Area Network**:** Needs, Topologies, IEEE Standards, Ethernet**:** Carrier Sense Multiple Access / Collision Detection, Token Ring, Token Bus

Field bus**:** The CIM Pyramid, Requirements & Types, Foundation Field Bus Architecture, CANopen, DeviceNet, Modbus, Profibus

BOOKS:

1. *Advanced Electronic Communication System*, Wayne Tomasi, Prentice Hall of India Private Limited.

2. *Data Communications and Computer Networks,* Prakash C. Gupta, Prentice Hall of India Private Limited.

3. *Electronic Instruments and Instrumentation Technology,* M. M. S. Anand, Prentice Hall of India Private Limited.

4. *Computer Networks*, Andrew S. Tanenbaum, Prentice Hall of India Private Limited.

5. *Modbus for Field Technicians,* Peter Chipkin, Chipkin

6. Foundation Fieldbus, Ian Verhappen & Augusto Pereira, ISA

PS03CINC23: PLC – DCS - SCADA
Total Marks:100 (External – 70, Internal – 30)

PLC**:** Advantages-Disadvantages, Overall System, Central Processing Unit, Input-Output Module Interfaces & Programming Formats, Construction of Ladder Diagrams, Scanning Considerations & Operational Faults, Input-Output On/Off Devices, Input-Output Analog Devices, PLC Input Instructions, Outputs**:** Coils & Indicators, Operational procedures, Contact and Coil I-O Programming Examples

Digital Logic Gates, Boolean Algebra PLC Programming, Conversion Examples, Ladder Diagrams and Construction, Characteristics of Registers, Module Addressing, Examples, Timer - Counter Functions & Examples, Intermediate and Data Handling Functions, Sequencer Functions, Types of PLC Analog Modules & Systems, PLC Analog Output Applications

Overview of Distributed Control System (DCS), EFMS Field Monitoring Station, Configuration of EFMS Field Monitoring Station, EFMS Field Monitoring Station Functions, Input Indication Functions, Annunciator Functions, Sequence Control Functions, Computational Functions, HMI, Man machine interface sequencing

Supervisory Control and Data Acquisition (SCADA), Introduction, Elements of SCADA. Features of SCADA , MTU, functions of MTU, RTU - Functions of RTU, Protocol Detail SCADA as a real time system Communications in SCADA - types & methods used, components, Protocol structure and Mediums used for communications SCADA Development for any one typical application Programming for
GUI development using SCADA software.

BOOKS:

1. *Programmable Logic Controllers- Principles and Applications,* John W. Webb & Ronald A. Reis, Prentice Hall of India Private Limited.

2. *Yokogawa Manual*

3. *Programmable Logic Controllers-Programming Methods and Applications,* John R. Hackworth & Frederick D. Hackworth, Jr.

4. *Computer-Aided Process Control,* S. K. Singh, Prentice Hall of India Private Limited.

5. *Computer based Industrial Control,* Krishna Kant, Prentice Hall of India Private Limited.

6. *SCADA - supervisory control and data acquisition*, Stuart A. Boyer, ― International Society of Automation Publication, 4thEdtion, 2009

M. Sc. (INSTRUMENTATION & CONTROL) – THIRD SEMESTER
PS03EINC21: OPTOELECTRONICS
Total Marks:100 (External – 70, Internal – 30)

Optical Sources**:** LED**-** Introduction, Structures & Characteristics, LASER**-** Basic Concepts, Optical Emission from Semiconductors & Non-semiconductor Lasers.

Optical Detectors**:** Introduction, Detection Principles, Absorption, Quantum Efficiency, Responsivity, Long Wavelength Cutoff, Phototransistors & Photoconductive Detectors.

Optical Fiber**:** Ray Theory, Single-mode Fibers, Attenuation, Losses, Dispersion & Polarization, Modes & Cables, Alignment, Splices, Connectors, Couplers, Receiver Noise, Optical Amplifiers, Optoelectronic Integration, Optical Computation.

Optical Transmitter-Receiver Circuit, Analog-Digital Systems, Optical Multiplexing, Optical Fiber systems**:** Detection System, Modulation Formats & Demodulation Schemes, Optical Fiber Measurements**:** Attenuation, Dispersion, Refractive Index Profile, Cutoff Wavelength, Numerical Aperture, Fiber Diameter, Field Measurements, Applications**:** Industrial, Sensor Systems, Local Area Networks.

BOOKS:

1. *Optical Fiber Communications – Principles and Practice,* John M. Senior, Pearson Education.

2. *Semiconductor Optoelectronic Devices,* Pallabh Bhattacharya, Prentice Hall of India Private Limited.

3. *Advanced Electronic Communication System*, Wayne Tomasi, Prentice Hall of India Private Limited.

M. Sc. (INSTRUMENTATION & CONTROL) – THIRD SEMESTER
PS03EINC22: SATCOM INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Microwave systems, Microwave transmitter & receivers, Microwave repeaters, Diversity – frequency, space & polarization, Microwave system gain, Free space path loss, fade margin, receiver threshold, noise figure

Satcom: Basic Principles: General features, frequency allocation for satellite services, properties of satellite communication systems, Satellite Orbits: Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

Satellite Construction (Space Segment): Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification Satellite Links: Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

Earth Station: Introduction, earth station subsystem, different types of earth stations. The Space Segment Access and Utilization: Introduction, space segment access methods, TDMA, FDMA, CDMA, SDMA, assignment methods. The Role and Application of Satellite Communication.

BOOKS:

1. *Advanced Electronics Communication Systems*, Wayne Tomasi
2. *Satellite Communications*, Timothy Pratt, Charles W. Bostian, John Wiley & Sons.
3. *The Satellite Communication Ground Segment and Earth Station Handbook*, Bruce R. Elbert
4. *Satellite Communications*, Dennis Roddy, Mc. Graw-Hill International
5. *Satellite Communication Systems Engineering*, W. L. Pritchard, J. A. Sciulli,Prentice-Hall, Inc.
6. *Satellite Communication Engineering*, M. O. Kolawole, Marcel Dekker, Inc. NY.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS03EINC23: DIGITAL SIGNAL PROCESSING
Total Marks:100 (External – 70, Internal – 30)

Signals & Systems, Classification of Signals, Singularity Functions, Systems**:** Classification, Transformation & Representation, Analog to Digital Conversion of Signals, Fourier Series**:** Trigonometric, Complex & Parseval's Identity, Power Spectrum of Periodic Function.

Fourier Transform, Discrete Time Fourier Transform (DTFT), Fast Fourier Transform (FFT), z-Transform.

Finite Impulse Response (FIR) Filters, Magnitude & Phase Response of Digital Filters, Design Techniques for FIR Filters, Design of Infinite Impulse Response (IIR) Filters from Analog Filters.

Structures for FIR Systems**:** Direct Form, Cascade Form, Frequency Sampling & Lattice, Structures for IIR Systems**:** Direct Form, Signal Flow Graph and Transposed, Cascade Form, Parallel Form & Lattice and Lattice-Ladder Form, Applications of Digital Signal Processing**:** Voice Processing, Radar, Image Processing, Introduction to Wavelets.

BOOKS:

1. *Digital Signal Processing,* S. Salivahanan, A. Vallavaraj & C. Gnanapriya, Tata McGraw-Hill Publishing Company Limited.

2. *Digital Signal Processing – Principles, Algorithms and Applications*, John G. Proakis & Dimitris G. Manolakis, Prentice Hall of India Private Limited.

3. *Digital Signal Processing – A Computer Based Approach,* Sanjit K. Mitra, Tata McGraw-Hill Publishing Company Limited.

4. *Introduction to Digital Signal Processing,* Johnny R. Johnson, Prentice Hall of India Private Limited.

5. *Fundamentals of Digital Signal Processing,* Lonnie C. Ludeman, John Wiley & Sons.