

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

**B.E.-III (Instrumentation & Control )**

**Semester- VI**

**Scheme For Teaching and Examination  
B.E.-III (Instrumentation & Control ) 6<sup>th</sup> Semester**

| <u>Course</u>                          | <u>Course No</u> | <u>Teaching Scheme</u> |   |    | <u>Examination Scheme</u>      |     |   |       |       |    |     |
|--|------------------|------------------------|---|----|--------------------------------|-----|---|-------|-------|----|-----|
|  |                  | L                      | T | P  | Theory Exam<br>University Exam |     | Pract/Quiz/Viva/T.W. etc.<br>Hrs Pract Int Tuto Total |       |       |    |     |
| Process Equipment Design               | IC 601 IC        | 3                      | 0 | 0  | 3                              | 100 | 0   | 0     | 0     | 0  | 0   |
| Measurement Techniques                 | IC 602 IC        | 3                      | 1 | 2  | 3                              | 100 | 3   | 30    | 20    | 25 | 75  |
| Industrial Control System              | IC 603 IC        | 3                      | 0 | 2  | 3                              | 100 | 3   | 30    | 20    | 0  | 50  |
| Analog & Digital Communication         | EC 604<br>EC/IC  | 3                      | 1 | 2  | 3                              | 100 | 3   | 30    | 20    | 25 | 75  |
| Analytical Instrumentation             | IC 605 IC        | 3                      | 0 | 2  | 3                              | 100 | 3   | 30    | 20    | 0  | 50  |
| Microprocessors Systems & Applications | EC 606<br>EC/IC  | 3                      | 0 | 2  | 3                              | 100 | 3   | 30    | 20    | 0  | 50  |
|  |                  | 18                     | 2 | 10 |                                | 600 |   | 150   | 100   | 50 | 300 |
|  | ( Total)         | 30                     |   |    |                                |     |   | Grand | Total |    | 900 |

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#### PROCESS EQUIPMENT DESIGN : IC 601 IC

|                          | Lecture | Tutorial | Practical                             |
|--------------------------|---------|----------|---------------------------------------|
| Teaching Hours           | 3       | 0        | 0                                     |
| Examination Scheme Marks | 100     | 0        | Cont. Evaluation 00<br>Examination 00 |

|    |  |
|----|--|
| 1. | <p><b>DESIGN ENGG. CRITERIA:</b></p> <ul style="list-style-type: none"><li>-Pneumatic v/s electronic systems : cost,safety,dependability,maintenance and process requirements.</li><li>-Specification of Flow,Temp.,Pressure,level and analytical instruments.</li><li>-Future and spare capacity.</li><li>- Control centers, Transmission systems, process connections.</li><li>- Miscellaneous design criteria : Mounting,selection of charts,unit ranges.</li></ul>   |
| 2. | <p><b>SELECTING MEASUREMENT METHODS :</b></p> <ul style="list-style-type: none"><li>-Selection and specification standards for various flow ,temp.,level and pressure instruments.</li></ul>   |
| 3. | <p><b>CONTROL VALVE :</b></p> <ul style="list-style-type: none"><li>-types, characteristics , rangeability Cv.</li><li>-Actuators,</li><li>-positioners.</li><li>-accessories.</li></ul>   |
| 4. | <p><b>CONTROL VALVE SIZING :</b></p> <ul style="list-style-type: none"><li>- Designing of control valves for gas, vapor, liquid etc.,</li><li>-Effect and remedies cavitation, flashing condition, noise on control valve, pressure drop across a valve,<br/>Sequenced valve arrangement, Valve linearizer,</li><li>- Testing procedure of control valve ,</li><li>-Flow characteristics of linear &amp; equal percentage,quick opening control valves on load changes,</li><li>-High pressure &amp; temp. service control valve, Installed ranges and viscosity correction for control valve.</li></ul> |
| 5. | <p><b>SPC IN PROCESS INDUSTRIES:</b> - Introduction of SPC (statistical Process Control), Graphic treatment for data collection, presentation and problem solving, - Descriptive measures, The normal distribution and its application, process capability, - Basics of control charting, Control charts for individual measurements averages and ranges, - Evaluation of control charts</p>   |

Tutorials will be based on theory.

**References:**

- (1) MERIT :Hydraulic control system ,Wiley Publication,reprint,Ed(1965).
- (2) CONSIDINE: Industrial Automation.(Process/Industrial Instrumentation &controls) Hand Book,Ahuja book company, Vth Ed.(1993).
- (3) HAW. D. BAUMANN: Control Valve Premier A Users' Guide,2/e,ISA Publication,1998.
- (4) PHILIP L. SKONSEN : Valve Handbook,Mc Graw Hill,Ed(1998).
- (5) HARRISON M. WADSWORTH : Handbook of Statistical Methods for engg. and scientists,McGraw Hill Publication, 2/e,1998.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## B.E.-III (Instrumentation & Control )

### Semester- VI

#### MEASUREMENT TECHNIQUES : IC 602 IC

|                          | Lecture | Tutorial | Practical                             |
|--------------------------|---------|----------|---------------------------------------|
| Teaching Hours           | 3       | 1        | 2                                     |
| Examination Scheme Marks | 100     | 25       | Cont. Evaluation 20<br>Examination 30 |

|          |  |
|----------|--|
| <b>1</b> | <b>INTRODUCTION OF MEASUREMENTS :</b> - Definition of Instrumentation.<br>- Static char. : - Accuracy, precision, resolution, Sensitivity, Scale, threshold, Hysteresis, Drift, deadzone, repeatability, Linearity, etc.<br>- Dynamic characteristics: Speed of Response, lag, errors, fidelity, Response of 1st & 2nd order system.<br>- Types of errors etc., - Terminology and Specifications of instruments,<br>- Measurement standards :- Time, frequency, Voltage, Current, 3-15 psi etc., ANSI, ASME, ADA, BS, DIN, CSMR, FCI, API, ISI, and introduction Reliability and safety. |
| <b>2</b> | <b>Temperature measurements :</b> Selection of device, installation, Calibration etc for followings :<br>(1) Thermocouples. (2) Thermometers. (3) Temp . gages. (4) RTD and $\mu$ . wire Tech. (5) Thermisters. (6) Radiation type pyrometers and optical pyrometers etc.  |
| <b>3</b> | <b>Flow Measuring devices and it's installation, Calibration.:</b><br>(1) Differential pressure types : - Principle, Types of Measuring devices like as Orifice, Venturi, Pitot tube etc.<br>(2) Differential Area types: - Principle, - Types of Measuring devices like as Rotameter, open channel , close channel etc., Magnetic meter, Turbine meter, Ultrasonic, Vortex, Positive displacement type, Mass flow, Anemometer, flow totalizer etc.<br>(3) Flow quantity meters : - Reciprocating meter, Tilt etc.,  |
| <b>4</b> | <b>Level Measuring Tech.:</b><br>(1) for Liquids and Solids : Float type displace, Air purge method, Capacitor Diaphragm box level gauges, DP cell, Load cell, Bicolour direct reading, Vibrating, Ultrasonic Radio active traducers, Read switches etc.<br>(2) Interacting and Non-interacting system for level.  |
| <b>5</b> | <b>Pressure measuring devices and it's installation, calibration etc.</b><br>(1) Pressure sales and standard and it's conversion.<br>(2) Devices : - Manometer ( different types ), - Burden type, - Bellows & Diaphragm, - Dead weight Testers,- Vacuum gages Testers, - Load cell,<br>- Piezo-electrical, - Strain gauge types, - Force Balance, - Mc Lead gauges.<br>- Thermal conductivity, - Re ionization type, - Sensors for high pressure, - Pressure switches etc.  |

Tutorials/practicals will be based on theory.

## References:

- (1) DONALD P. ECKMAN :Automatic process control ( Industrial instrumentation), Wiley Eastern ltd, Ed (1991)
- (2) LIPTAK : Instrument Engg. Handbook, Chilton Book Co. ,Pensilvenia,P( 1994).
- (3) RANGAN MANI SHARMA: Instrument Devices and Systems,TMH Publication,2/e,1997.
- (4) R.K.JAIN: Mech. and Ind. Instrumentation ,Khanna Publishers,10/e,1996.
- (5) DOEBELIN : Measurement systems : Application and design, TMH publication,4/e, 1990
- (6) W.G.ANDREWS: Applied Instrumentation in process industry Vol. I & II ,Gulf Book Co.,1994
- (7) J.P.HOLMAN: Experimental Methods for Engineers,TMH publicaition,6/e,1994.
- (8) B.E.JONES: Instrument Technology (Instrumentation feedback & measurement) TATA McGraw Hill,E (1997)
- (9) PATRANABIS: Principle of Industrial Instrumentation, TMH publication,2/e,1998.

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### Semester- VI

#### INDUSTRIAL CONTROL SYSTEM : IC 603 IC

|                          | Lecture | Tutorial | Practical                             |
|--------------------------|---------|----------|---------------------------------------|
| Teaching Hours           | 3       | 0        | 2                                     |
| Examination Scheme Marks | 100     | 0        | Cont. Evaluation 20<br>Examination 30 |

|    |   |
|----|---|
| 1. | BOILER INSTRUMENTATION AND CONTROL : - Combustion Control, Three level drum Control Steam, Lamp and pressure control, Flow of steam to Control.   |
| 2. | TURBINE INSTRUMENTATION & CONTROL: - Speed Measurement of turbine shaft & Maintain constant to control, - Vibration, axial moment and other parameter Measurement.  |
| 3. | CONTROL OF HEAT EXCHANGERS : - Types of heat Exchangers, - Dynamics of steam, - Heat Exchanges, - Response of charge in temp. -Types of Control Scheme and tuning, - Calculation and reduction of process lag.  |
| 4. | DISTILLATION COLUMN CONTROL : - Basic features of composition, - Control scheme, - Control of overhead and bottom composition, - Distillation model equation, - process and control equation, - Temp. & Pressure Control, - Floating pressure Control, - Reflex Control.  |
| 5. | REACTOR CONTROLLING : - Controlling Scheme for different types of reactor, - Operations, Stability and Safety devices.  |
| 6. | DESECRATE STATE PROCESS CONTROL : - Architecture, Discrete input, output System, I/o Modular, - Analog & Digital I/O Modules, - intelligent, Communication and Designing I/O Modules. - Memory & Storage : Memory Map, - Hardware to Software and visevers an interface. - Programming Languages :<br>* Development of ladder diagram from flow chart for complex System.<br>* Advance Programming of PLC ( Like as cascading timer, Counters, MCS-MCB shift Reg. sequential process, arithmetic functions )<br>* PLC Simulator,<br>* PLC to PC and pc through Control on process with graphical display. |

#### References:

- (1) Applied Instrumentation in process Industries Volume: II : By Andrews.
- (2) Automatic Control for power and process : By Matifold.
- (3) Programmable Logic Controller : By J.D.Otter.
- (4) Process Control Instrumentation Technology : By C.D.Johson.
- (5) Applied Instrumentation : By Andrews, Gulf.
- (6) Programmable Controllers : By T.A.Hughes

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## B.E.-III (Instrumentation & Control )

### Semester- VI

#### ANALOG AND DIGITAL COMMUNICATION: EC 604 EC/IC

|                             | Lecture | Tutorial | Practical                                 |
|-----------------------------|---------|----------|---|
| Teaching Hours              | 3       | 1        | 2   |
| Examination Scheme<br>Marks | 100     | 25       | Cont. Evaluation : 20<br>Examination : 30 |

|    |   |
|----|---|
| 1. | Spectral Analysis Parameters: Fourier Series, Power Spectral Density, Convolution, Correlation between waveforms, Auto and Cross correlation, Sampling Theorem.   |
| 2. | Analog Input Analog Output Schemes: Amplitude Modulation: Equation for AM, modulation index, spectrum of AM, DSB and SSB transmission with and without carriers, VSB transmission, DSB,C amplitude modulators, Envelope detectors, Balanced Modulator, SSB signal generation and Demodulation schemes.    |
| 3. | Frequency modulation: Equations for FM, modulation Index, spectrum calculation for sinusoidal waveform and Bessels function table, phase modulation, relationship between FM and PM, NBFM and WBFM, frequency modulators and demodulators (Armstrong method) Types of noise : Noise in AM and FM systems. |
| 4. | Digital Input Analog Output Schemes: ASK, FSK,QAM, BPSK, QPSK, Transmitter and receiver block diagrams.   |
| 5. | Analog Input Digital Output Schemes: Various pulse modulation methods, Pulse code modulation PCM, Delta modulation DM. Comparison between PCM and DM, Compounding method, Noise In digital systems  |
| 6. | Digital Input Digital Output Schemes: Line encoding methods : NRZ, RZ, Manchester, and multilevel encoding methods and comparison of these schemes  |
| 7. | Source coding : Linear predictive coding, Huffman coding  |
| 8. | Multiplexing : FDM and TDM systems, examples and comparison   |

Practical work shall be based upon the theory course.

#### References :

1. B.P.LATHI: Modern digital and analog communication systems. Holt,Sounders (HRW Series) Publication. 1998.
2. DENNIS RODDY AND JOHN COOLEN : Electronic communications. Fourth Edition,PHI 1995
3. TAUB AND SCHILLING : Principles of communication. Systems. Mc Graw Hill Publication, 1992.
4. P. CHAKRABARTY : Analog Communication Systems, Dhanpatray and Sons Publication, 1/e,1998.

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## B.E.-III (Instrumentation & Control)

### Semester- VI

#### ANALYTICAL INSTRUMENTATION : IC 605 IC

|                          | Lecture | Tutorial | Practical                             |
|--------------------------|---------|----------|---------------------------------------|
| Teaching Hours           | 3       | 0        | 2                                     |
| Examination Scheme Marks | 100     | 0        | Cont. Evaluation 20<br>Examination 30 |

|          |   |
|----------|---|
| <b>1</b> | <p>U.V. AND VIS ABSORPTION METHODS :</p> <ul style="list-style-type: none"><li>- Law of photometry ( Beer and Lambert's ), - U.V. &amp; VIS absorption instruments components, - Monochromator design and associated equipment, Monochromator performance.</li></ul> <p>U.V. and VIS instruments : Color meters, Single &amp; Double beam Spectra meters, Dual wavelength and double monochromator Systems, IR Spectro photo meters, Fourier transformation.</p>  |
| <b>2</b> | <p>MASS SPECTROMETRY : - Basic mass Spectrometer components,</p> <ul style="list-style-type: none"><li>-Types of meters : Magnetic deflection type, time of flight, radio frequency, double focusing, Quadruple type - Gas Chromatography. mass spectra meter - GCMS System, resolution of Mass Spectra meters and Its applications.</li></ul>  |
| <b>3</b> | <p>RADIO CHEMICAL INSTRUMENTS : - Radio chemical Methods,</p> <ul style="list-style-type: none"><li>- Radiation detectors - Ionization chamber, - Geiger Mueller Counter,</li><li>- Proportional Counter, - Scintillation Counter, - Semiconductor detector,- Pulse height analyzer.</li></ul>  |
| <b>4</b> | <p>GAS AND LIQUID CHROMATOGRAPHY : - Classification, basic parts of gas chromatography-carrier gas, Sample injection System, chromatographic Column, - Thermal compartment, temp. programming, dual Column System, - Detector-thermal Conductivity, Flame ionization,</p> <ul style="list-style-type: none"><li>- electron Capture : Argon ionization detector etc.,</li><li>- Other methods of gas analysis :</li></ul> <p>(1) Oxygen Analyzer. (2) Carbon monoxide Analyzer. (3) Carbon dioxide Analyzer. (4) Nitrogen. (5) Gas density Analyzer. (6) Smoke detector etc.</p> |
| <b>5</b> | <p>OPTO-ELECTRONIC DEVICES :</p> <p>(1) Characterization and application of LED, photo-diode, photo-transistor, LDR, thermister Bar graph display, Opto isolator and photo coupler with it's different types.</p> <p>(2) Types of LCD, dynamic, Scattering, Principle and Characteristics.</p> <ul style="list-style-type: none"><li>- Ultrasonic generation and Applications, - Light Spectrums and it's Analysis.</li></ul>   |
| <b>6</b> | <p>MISCELLANEOUS MEASUREMENTS :</p> <ul style="list-style-type: none"><li>- pH measurement,</li><li>- Conductivity measurement</li><li>-Humidity and moisture measurement</li><li>-Flume detector, Lock detector flame detector, Smoke detector etc.</li><li>- Density Measurements</li><li>-Dissolve oxygen measurement.</li></ul>   |

Practicals will be based on theory.

**References:**

- (1) R.S.KHANDPUR: Hand book of Analytical Instrumentation ,Tata McGraw Hill,p(1996).
- (2) DONALD P.ECKMAN :Instrumentation,Wiley eastern India,Ed(1991).
- (3) MOTTERSHEAD ALLEN : Electronic Devices & Circuits: An introduction, PHI, New Delhi,19th Ed.(1997).
- (4) LIPTAK : Analytical Instrumentation, Chilton Book Co.,Pensilveniya,P(1996)

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### Semester- VI

#### MICROPROCESSOR SYSTEMS AND APPLICATIONS: EC 606 EC/IC B. E. III ( IC) 6<sup>th</sup> Semester.

|                             | Lecture | Tutorial | Practical                                 |
|-----------------------------|---------|----------|---|
| Teaching Hours              | 3       | 0        | 2   |
| Examination Scheme<br>Marks | 100     | 0        | Cont. Evaluation : 20<br>Examination : 30 |

|    |   |
|----|---|
| 1. | Introduction to 16 bit Microprocessor: 8086/8088 Architecture, Machine language instructions, Internal execution and timing   |
| 2. | 8086/8088 Family Assembly Language Programming: Data transfer instructions, Arithmetic instructions, Logical, shift and rotate instructions, Branch instructions, Loop instructions, NOP,HLT and flag manipulation instructions, Assembler directives.                  |
| 3. | 8086 System Connections And Timings: 8086 Hardware overview, Basic signal flow on 8086 buses, Analyzing a minimum mode system, 8086 addressing and address decoding, 8086 timing parameters.  |
| 4. | Interrupts And Interrupt Service Procedures: 8086 interrupts and interrupt responses, 8086 Interrupt types, Hardware and software considerations for using interrupts.  |
| 5. | I/O Programming: Fundamental I/O considerations, Programmed and Interrupt I/O, Block transfers and DMA, I/O design example.   |
| 6. | Interfacing: Programmable parallel ports and handshake input/output, Interfacing microprocessors to keyboard and displays, D/A converter operation, Interfacing and applications, A/D converter types, Specifications and interfacing, Serial communication interfaces. |
| 7. | Introduction to Microcontrollers: Basics of 8031 and 8051 architecture and programming, introduction to 16 bit micro controllers  |
| 8. | Applications: Temperature , Pressure, Level & Traffic Control.  |

Practical work shall be based upon the theory course.

#### Reference:

1. HALL DOUGLAS V: Microprocessors and Interfacing, Programming and Hardware (Tata McGraw Hill Publishing Company Limited 1991)
2. GIBSON GLENN A. and Liu Yu Cheng: Microcomputer Systems: The 8086/8088 Family, Architecture, Programming and Design (Prentice Hall of India Private Limited, New Delhi, Second Edition,1994)
3. MCS 86 User's Manual (Santa Clara, Calif.: Intel Corporation,1993)
4. MORSE, STEPHEN P. :The 8086 Premier: An Introduction to It's Architecture, System Design and Programming (Rochelle Park,N.J.: Hayden Book Company, Inc., 1989)
5. TRIEBEL AND SINGH:The 8088 and 8086 Microprocessor Programming, Interfacing, Software, Hardware and Applications, PHI, 1991

TITLES GIVEN IN BRACES REPRESENT SIMILAR BOOKS BY THE SAME AUTHOR.