

**UTTRAKHAND TECHNICAL UNIVERSITY,  
DEHRADUN  
STUDY & EVALUATION SCHEME**

B. Tech.(1) Instrumentation and Control Engineering (2) Applied Electronics & Instrumentation  
(3) Electronics & Instrumentation (4) Electronics Instrumentation & Control and  
(5) Instrumentation Engineering

**YEAR III**

**SEMESTER-VI**

| S. No.                            | Course Code | SUBJECT                            | PERIODS |   |   | Evaluation Scheme |                |       | ESE | Subject Total |
|-----------------------------------|-------------|------------------------------------|---------|---|---|-------------------|----------------|-------|-----|---------------|
|                                   |             |                                    | L       | T | P | CT                | SESSIONAL EXAM |       |     |               |
|                                   |             |                                    |         |   |   |                   | TA             | Total |     |               |
| <b>THEORY</b>                     |             |                                    |         |   |   |                   |                |       |     |               |
| 1.                                | TAS-601     | Industrial Management              | 3       | 1 | 0 | 30                | 20             | 50    | 100 | 150           |
| 2.                                | TIC-601     | Microcontroller & Embedded Systems | 3       | 1 | 0 | 30                | 20             | 50    | 100 | 150           |
| 3.                                | TIC-602     | Data Acquisition & Telemetry       | 3       | 1 | 0 | 30                | 20             | 50    | 100 | 150           |
| 4.                                | TIC-603     | Process Control Engg.              | 3       | 1 | 0 | 30                | 20             | 50    | 100 | 150           |
| 5.                                | TIC-602     | Digital Signal Processing          | 3       | 1 | 0 | 30                | 20             | 50    | 100 | 150           |
| <b>PRACTICAL/TRAINING/PROJECT</b> |             |                                    |         |   |   |                   |                |       |     |               |
| 6.                                | TIC-651     | Microcontroller Lab                | 0       | 0 | 2 | -                 | 20             | 20    | 30  | 50            |
| 7.                                | TIC-652     | Transducers & Telemetry Lab        | 0       | 0 | 2 | -                 | 20             | 20    | 30  | 50            |
| 8.                                | TEC-652     | Digital Signal Processing Lab      | 0       | 0 | 2 | -                 | 20             | 20    | 30  | 50            |
| 9.                                | GP-601      | General Proficiency                | -       | - | - | -                 | -              | -     | -   | 100           |
| 9.                                | DIS-601     | Discipline                         |         |   |   |                   |                |       |     | 100           |
|                                   |             | <b>Total</b>                       |         |   |   |                   |                |       |     | <b>1100</b>   |

Note- 4 to 6 Weeks Industrial Interaction after VI semester exam to be evaluated in VII semester

**YEAR III**

**SEMESTER-VI**

**Industrial Management (TAS-601)**

| Unit | Topic   | Text Book/Chapter   | Lectures |
|------|---|---------------------|----------|
| 1    | What is Operations Research? OR-research model, solving the OR model, Queuing and simulation models, Art of modeling, Phases of OR study. | 1/1 Except 1.5, 1.7 | 2        |
| 2.   | <b>Introduction to Linear Programming:</b><br>Two variable L-P model, Graphical LP solution, Analysis of selected LP models.              | 1/2.1, 2.2, 2.5     | 3        |

|    |  |                                 |   |
|----|--|---------------------------------|---|
|    | <b>The Simplex Method:</b> LP solution space, Graphical to algebraic solution, The simplex method, Artificial starting solution, Special cases in simplex method applications. | 1/3                             | 4 |
|    | <b>Transportation Model and its Variants:</b> Definition of transportation model, Non-traditional transportation models, Transportation algorithms, Assignment model           | 1/5 Except 5.5                  | 4 |
| 3. | <b>Network Models:</b> Network definitions, Minimal spanning tree algorithm, CPM and PERT.   | 1/6.1, 6.2, 6.6                 | 4 |
|    | <b>Game Theory:</b> Optimal solution of two persons zero sum games, Solution of mixed strategy games.  | 1/ 14.4                         | 2 |
| 4. | Introduction to Patents and Intellectual Propriety Right   |                                 | 3 |
|    | <b>Introduction to Engineering Management:</b><br>Engineering and Management<br>Historical Development of Engineering Management   | 1/1<br>1/2                      | 3 |
| 5. | <b>Functions of Technology Management</b><br>Planning and Forecasting<br>Decision Making<br>Organizing<br>Motivating and Leading Technical People<br>Controlling               | 2/3<br>2/4<br>2/5<br>2/7<br>2/8 | 6 |
|    | <b>Project Management</b><br>Project Planning and Acquisition<br>Project Organization, Leadership, and Control   | 2/14<br>2/15                    | 4 |

**Text Books:**

1. Hamdy H Taha, Operations Research – An Introduction; 7e, Pearson Education/ PHI – 2002.
2. Babcock & Morse, Managing Engineering and Technology; Pearson Education, 2004

**Reference Books:**

1. Hillier & Hillier, Introduction to Management Science; TMH Ed 05

**Microcontroller & Embedded Systems (TIC-601)**

| Unit | Topic  | Text Book/<br>Chapter              | Lectures |
|------|--|------------------------------------|----------|
| 1.   | Introduction to Microcontroller: Microcontrollers and Microprocessors, Embedded versus external memory devices 8 and 16-bit micro controllers, CISE & RISC processors; Harivard & Von-Neumann architecture commercial Microcontroller devices. | 1/1                                | 6        |
| 2.   | 8051 Microcontrollers: Architecture, pins description I/O ports and memory organizations interrupts, timer & serial communication, addressing mode and instructions, simple programs, assembly language programming tools.                     | 1/2<br>1/3,<br>1/4,<br>1/5,<br>1/6 | 12       |
| 3.   | Architecture, pin description & features 8096/95, 98CXX,89C20XX, PIC micro-controllers, AVR micro- <sup>2/</sup> controllers.  | 1/7, 1/9<br>1/7                    | 8        |

|    |  |             |   |
|----|--|-------------|---|
| 4. | Interfacing: LEDs, Push Buttons, Relay and Latch connections, keyboard, 7-segment display, and LCD interfacing ADC and DAC interfacing.        | 1/12        | 8 |
| 5. | Applications of Microcontroller different waves generation, frequency counter, Measurement applications, automation and controller application | 1/13<br>1/8 | 6 |

**Text Books:**

1. Ajay V. Deshmukh, Microcontrollers; Theory and applications; TMH edition 2005.
2. John Catsoulis, Designing Embedded Hardware; O' Reilly edition 2002.

**Reference Books:**

1. B.P. Singh & Renu Singh, Advanced Microprocessors and Microcontrollers; New Age International Publishers Edition 2005.
2. Raj Kamal, Embedded Systems Architecture Programming and Design, TMH Edition 2005.

### Data Acquisition & Telemetry (TIC-602)

| Unit | Topic  | Text Book/<br>Chapter | Lectures |
|------|--|-----------------------|----------|
| 1.   | <b>Introduction to Telemetry Principles:</b> Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems, Frequency Telemetry, Power line  | 1/1                   | 2        |
| 2.   | <b>Multiplexed System:</b> Frequency Division Multiplex System-FDM, IRIG Standards, FM circuits, Phase Modulation Circuits, Receiving end, Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system, PAM/PM systems, TDM- PCM System, Digital Multiplexer, PCM Reception, Coding | 1/4, 1/5              | 10       |
| 3.   | <b>Modems:</b> Modems Introduction, QAM, Modem protocol  | 1/6                   | 4        |
| 4.   | <b>Transmitter and Receiver:</b> Transmitters, Transmission Techniques, Inter stage Coupling, Receiver<br><b>Antennas:</b> The Ideal structure, dipoles, arrays, current distribution  | 1/7, 1/9              | 10       |
| 5.   | <b>Filters:</b> Polynomial, Filters, Active RC Filters, Universal Filter Circuits, Switched Capacitor Filters, Digital Filters   | 1/11                  | 4        |
|      | <b>Basics of Satellite and Fiber Optic Telemetry</b>   | 1/12, 1/13            | 8        |
|      | Data Acquisition Systems (DAS), $\mu$ P based DAS, Remote Control  | 1/14                  | 4        |

**Text Book:**

1. D Patranabis, Telemetry Principle; TMH Ed 1 1999

## Process Control Engineering (TIC-603)

| Unit | Topic   | Text Book/<br>Chapter | Lectures |
|------|---|-----------------------|----------|
| 1    | Signal Conditioning<br>~ Analog<br>~ Digital  | 1/2<br>1/3            | 10       |
| 2.   | Signal conversions, Actuators & Control Elements :<br>~ Final control operation<br>~ Signal conversations<br>~ Actuators<br>~ Control elements                                | 1/7                   | 6        |
| 3    | CONTROLLER PRICIPLES: Introduction, Process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes. | 1/9                   | 6        |
| 4    | CONTROLERS (a) Analog (b) Digital: Introduction, general features, electronic controllers, Pneumatic controllers, and Design considerations.                                  | 1/10, 1/11            | 10       |
| 5    | CONTROL LOOP CHARACTERISTICS: Introduction, control system configuration, multi variable control systems, control   | 1/12                  | 6        |

### TEXT BOOKS:

1. Process Control Instrumentation Technology, JOHNSON CURTIS, Prentice Hall of India, 7th edition.

### REFERENCE BOOKS:

1. Chemical process Control: An introduction to theory and practice, STEPHANOPOULS G, Prentice Hall of India, ISBN-8 1-203-0665-1.
2. Computer Aided Process Control, S K SINGH, Prentice Hall of India, ISBN-8 1-203-2282-7.
3. Automated Process Control Electronics, HARRINGTON J & ALBANY, Prentice Hall of India, 1989.
4. Instrument Engineers Hand Book, Process Measurement Volume-I, Process Control Volume – II, BELA.G. LIPTAK, Chilton Book Company / Radnor, 3rd edition, Pennsylvania, 1969).

## Digital Signal Processing (TEC-602)

| Unit | Topic  | Text Book/<br>Chapter | Lectures |
|------|--|-----------------------|----------|
| 1.   | <b>Discrete Fourier Transform:</b><br>Frequency Domain Sampling: The Discrete Fourier Transform<br>Frequency- Domain Sampling and Reconstruction of<br>Discrete-Time Signals. The Discrete Fourier Transform (DFT).<br>The DFT as a linear Transformation. Relationship of the DFT to<br>Other Transforms. Properties of the DFT.<br>Periodicity, Linearity, and Symmetry Properties. Multiplication<br>of two DFTs and Circular Convolution. Additional DFT<br>Properties. Frequency analysis of signals using the DFT. | 1/5                   | 10       |
| 2.   | <b>Efficient Computation of DFT</b><br>Efficient Computation of the DFT: FFT Algorithms, Direct<br>Computation of the DFT. Radix-2 FFT algorithms. Efficient<br>computation of the DFT of two real sequences, computations,<br>Efficient computation of the DFT of a 2N- Point real sequences,<br>Gortzel Algorithm, Chirp Z-transform algorithm.  | 1/6                   | 10       |
| 3.   | Basic IIR Filter Structures: Direct forms (I & II), cascade and<br>parallel realizations. Signal flow graph, Transposed<br>structure, Basic FIR filter structures-. Direct form structure,<br>frequency sampling structure, Lattice structure, Linear phase<br>FIR structure. FIR structures.  | 1/7                   | 08       |
| 4.   | Symmetric and Anti-symmetric FIR Filters, Design of<br>Linear-Phase FIR Filters Using Windows, Design of<br>Linear-Phase FIR Filters by the Frequency Sampling Method,<br>Design of FIR, Equiripple filter design Differentiators. Design of<br>Hilbert Transformers.  | 1/8                   | 08       |
| 5.   | <b>Design of IIR Filters From Analog Filters:</b> IIR Filter Design by<br>Approximation of Derivatives, IIR Filter Design by Impulse<br>Invariance. IIR Filter Design by the Bilinear Transformation. The<br>Matched-z Transformation, Characteristics of Commonly Used<br>Analog Filters. Application of above technique to the design of<br>Butterworth & Chebyshev filters.   | 1/8                   | 08       |

### Text Books:

1. Proakis, J.G. & Manolakis, D.G., "Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall (India).

### Reference Books:

1. Sanjit K. Mitra, "Digital Signal Processing", Third Edition, TMH, 2005
2. Oppenheim A.V. & Schafer, Ronald W., "Digital Signal Processing", Pearson Education.
3. Rabiner, L.R. and Gold B., "Theory and applications of DSP", PHI.
4. DeFatta, D.J., Lucas, J.G. & Hodgkiss, W.S., "Digital Signal Processing", John Wiley & Sons

## **Microcontroller Lab (TIC-651)**

### 8051 Based Experiments

1. Hexadecimal Addition of two numbers.
2. Splitting a Byte in to nibbles.
3. Check the number for being ODD or EVEN.
4. Hex multiplication of two numbers.
5. Display a character on CRT.
6. Display the number in accumulator on CRT screen.
7. Stepper motor control using Microcontroller.
8. Downloading and Uploading FROM/ON PC memory using XTALK software.

## **TRANSDUCER & Telemetry lab(TIC- 652)**

1. Characteristics of resistance transducer
  - (i.) Potentiometer
  - (ii.) Strain Gauge/ Measurement of Strain using quarter, half and full bridge.
2. Characteristics of LVDT.
3. Characteristics of capacitance transducer:
  - (i) Variable area
  - (ii) Variable distance.
4. Characteristics of Thermistors
5. Characteristics of RTD.
6. Thermocouples and AD590.
7. Characteristics of LDR, Photo Diode, and Phototransistor:
  - (i) Variable Illumination.
  - (ii) Linear Displacement.
- 8 Characteristics of diaphragm type pressure transducer.
9. Study of Storage Oscilloscope & Transient response of RLC.
10. Instrumentation Amplifier: Design for specific gain and verification of CMRR.
11. Characteristics of a Strain Gauge.
- 12..Study of Sampling and reconstruction techniques.
13. Study of pulse data coding techniques for NRZ formats.
14. Study of Pulse code modulation and demodulation.
15. Study of amplitude shift keying modulator and demodulator.
16. Study of frequency shift keying modulator and demodulator.
17. Study of phase shift keying modulator and demodulator

## **Digital Signal Processing Lab (TEC-652)**

1. Sampling & Waveform Generation.
2. Quantization
3. PCM Encoding
4. Delta Modulation
5. Digital Modulation Schemes (ASK, PSK, FSK)
6. Error Correcting Codes
7. DFT Computation.
8. Fast Fourier Transform.
9. FIR Filter implementation.
10. IIR Filter implementation.
11. DSP Processor Implementation
12. Computational Experiments with Digital Filters.