B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UHSS601 **Paper name: Engineering Economics** **Credit: 6**
Total contact hours: 36 **L-T-P: 3-0-0**

Module 1: **Contact Hours: 07**

Definition of Economics, Consumer behaviour,Utility analysis and demand analysis, Kinds of Demand, Law of Demand and Law of Supply, Elasticity of Demand: Types and Measurement, Scope of Economics including economics of environment and e-commerce.

Module 2: **Contact Hours: 08**

Market forms-Perfect and Imperfect markets, Features of Perfect competition, Monopoly and Monopolistic competition. Price and output determination under Perfect Competition, Monopoly, Monopolistic and Oligopoly etc. Concept of Production function, Cost Analysis, Estimation of cost function-Profit and Break Even Analysis.

Module 3: **Contact Hours: 07**

National Income,GNP and NNP,Per-Capita Income, Source of Public Revenue-Tax Revenue and Non-Tax Revenue, Direct and Indirect Tax. Inflation and Deflation. Banking-Definition-Types and function of Bank. Concept of Investment Analysis.

Module 4: **Contact Hours: 07**

Features of Indian Economy, Economic Reforms in India-Concept of Economic Liberalization, Privatization and Globalization , Unemployment Problem in India-Types, Causes , remedial measures and recent employment generation scheme of Government of India.

Module 5: **Contact Hours: 07**

International Trade, Gains from International Trade, The World Trading Environment and Multinational Corporations, BPO etc. Function and Role of IMF, World Bank and WTO.Concept of Stock Exchange Market and Market for Securities.

Reference Book:

I)Samuelson, P. A. and W. D. Nordhaus , Economics, McGraw Hill, New York
ii) Mishra, Sasmita (2009), Engineering Economics and Costing, Prentice Hall of India Pvt. Limited
III) Thuesen, G. J. and W. J. Fabrycky, Engineering Economics, Prentice Hall of India, New Delhi
IV) Dwivedy, D. N. (6th ed), Managerial Economics, Vikas Publishing House
V) Mishra, R, Engineering Economics, University Science Press, New Delhi
VI) Datt & Sundharam (latest edition), Indian Economy, S. Chand Publication, New Delhi
VII) Misra & Puri (latest edition), Indian Economy, Himalaya Publishing House
VIII) Ahmed , A and Begum , G , Engineering Economics ,Chandra Prakesh , Guwahati

B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UIE601 **Paper name: Process Control** **Credit: 6**
Total contact hours: 37 **L-T-P: 3-0-0**

Module 1: **Contact hours: 08**

Process Control System: Terms and objectives, piping and Instrumentation diagram, instrument terms and symbols. Regulatory and servo control, classification of variables. Process characteristics: Process equation, degrees of freedom, modeling of simple system, Self-regulating processes, interacting and non- interacting processes, Process lag, load disturbance and their effect on processes.

Module 2: **Contact hours: 08**

Controller Modes: Basic control action, two position, multi-position, floating control modes. Continuous controller modes: proportional, integral, derivative. Composite controller modes: P-I, P-D, P-I-D, Integral wind-up and prevention. Auto/Manual transfer, Bumpless transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow.

Module 3: **Contact hours: 07**

Final Control Elements: Pneumatic and electrical actuators, Valve positioners. Pneumatic and electrical dampers, Control valves types, construction details, and various plug characteristics. Energy efficient valves - Valve sizing - selection of control valves. Inherent and installed valve characteristics. Fail-safe operation, Cavitation and flashing in control valves, Instrument air supply specifications.

Module 4: **Contact hours: 07**

Controller Tuning Methods: Evaluation criteria - IAE, ISE, ITAE. Process reaction curve method, continuous oscillation method, damped oscillation method. Auto tuning. Closed loop response of I & II order systems, with and without valve, measuring element dynamics.

Module 5: **Contact hours: 07**

Advanced Control system: Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, interaction of control loops. Introduction to Dynamic Matrix Control. Case Studies: Distillation column, boiler drum level control and chemical reactor control.

Books / References:

1. G. Stephanopoulos, Chemical Process Control-An Introduction to Theory and Practice. Prentice Hall of India, New Delhi, 3rd Edition, 2008.
2. D.R. Coughanowr, Steven E LeBlanc, Process Systems Analysis and Control, McGraw Hill, Singapore, 3rd Edition, 2009.
3. B.W. Bequette, Process Control Modeling, Design and Simulation. Prentice Hall of India, New Delhi, 2004.
4. William C. Dunn, Introduction to Instrumentation, Sensors, and Process Control, Artech House Publishers, 2005.
5. C.A. Smith and A.B Corripio., Principles and Practice of Automatic Process Control, John Wiley and Sons, New York, 3rd Edition2005.
6. Paul W. Murril, Fundamentals of Process Control Theory, ISA press, New York, 3rd Edition, 2000.
7. Bela G. Liptak, Instrument Engineers' Handbook, Volume II: Process Control and Optimization, CRC Press, 4th Edition,2005.
8. D.E. Seborg, T.E. Edgar, D.A. Mellichamp. Process Dynamics and Control, Wiley India Pvt. Ltd., Fourth Edition.2016.
9. Wolfgang Altmann, Practical Process Control for Engineers and Technicians , Elsevier/Newnes publishing, 2009
10. Donald P. Eckman, Automatic Process Control, Wiley India Pvt Ltd , 2009.

B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UIE602 **Paper name: Electronic Instrumentation** **Credit: 6**
Total contact hours: 36 **L-T-P: 3-0-0**

Module 1: Analog Electronic Meters **Contact Hours: 07**

D.C and A.C electronic voltmeters and ammeters, ohmmeter, multimeter, power meter, Q-meter, true RMS meter, vector voltmeter, measurements of resistance, inductance and capacitance using electronic instruments, LCR meter..

Module 2: Signal Generators and Analysers **Contact Hours: 08**

Signal generators: Oscillators, VCO, PLL, sine wave generator, frequency synthesized sine wave generator, sweep frequency generator, ramp, pulse, square and triangular wave generator, Schmitt trigger and function generator. Audio frequency and noise generator.
Signal analyzers: Harmonic distortion analyzer, signal and spectrum analyzer.

Module 3: Cathode Ray Oscilloscope **Contact Hours: 09**

Introduction, Cathode ray tube, Electrostatic deflection, post deflection acceleration, screens for CRTs, vertical deflection system, horizontal deflection system, free running and triggered mode, delay line, oscilloscope probes, measurements of voltage, frequency and phase using oscilloscope, Lissajous patterns.
Special oscilloscopes: storage oscilloscopes and sampling oscilloscope, DSO.

Module 4: Digital Instruments **Contact Hours: 05**

ADC and DAC, digital voltmeter systems, digital multimeters, digital frequency meter systems.

Module 5.Additional Topics **Contact Hours: 07**

IEEE 488 bus, Display and Recording Devices, Bar graph display, Segmental and dot matrix display, strip chart, circular and X-Y recorders, magnetic tape recorders, Data loggers. Interferences and screening.

Books/References:

1. Albert D. Helfrick & William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, 2002.
2. B. M. Oliver and J. M. Cage, 'Electronic Measurements & Instrumentation', McGraw Hill International Edition, 1975.
3. D. A. Bell, 'Electronic Instrumentation and Measurements', Prentice Hall of India, 2002.

B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UIE603 Paper name: Optical Fiber and Optoelectronics Credit: 6
Total contact hours: 36 hours L-T-P: 3-0-0

Module 1: Contact hours: 10

Optical Fiber and Their Properties: Introduction; Physical nature of optical fiber; Basic principle involved in optical fiber technology; Fibre classification; Acceptance angle, Acceptance cone, Numerical aperture of a fiber; Optical fiber bundles and cables; Fiber splicers, connectors and couplers; Fiber attenuation; Loss mechanisms; Dispersion in optical fiber; Manufacturing of fiber; Advantages and disadvantages of using optical fiber as communication medium.

Module 2: Contact hours: 06

Sources and detectors for Optical Fiber Communications: Introduction; Communication requirements; LASER fundamentals, Semiconductor LASER basics; LASER diode characteristics; LED structures & characteristics; Detectors for optical fiber communications; Basic Principle, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, Avalanche photodiodes, CCDs, Image Intensifiers, Arrays, Solar Cells, noise considerations.

Module 3: Contact hours: 05

Optical Communication: Introduction; Typical communication system; the fiber optic communication system; Optical telecommunication system; Present status and future trends.

Module 4: Contact hours: 09

Optical Fiber Sensors: Introduction; Advantages of optical fiber sensors; Generic optical fiber sensors; Classification; Modulation Schemes; Fields of applications.

Evanescent field absorption sensors; Reagent mediated sensors; Wavelength modulated sensors; Interferometric sensors; Polari metric sensors, Frequency modulated sensors; Fiber Bragg grating based sensors; Surface Plasmon resonance based sensor; Distributed sensors; Miscellaneous sensors.

Module 5: Contact hours: 06

Hologram and Medical Applications Holography: Basic principle; Methods; Holographic interferometry and application; Holography for non-destructive testing; Holographic components; Medical applications of lasers, Laser and tissue interactive; Laser instruments for surgery, removal of tumours of vocal cords, brain surgery, plastic surgery, gynaecology and oncology.

Books / References:

1. Ghatak, A., Thyagarajan, K. (1998). An introduction to fiber optics. Cambridge university press.
2. Gupta, Banshi Dhar. Fiber optic sensors: principles and applications. New India Publishing, 2006.
3. Senior, John M., and M. Yousif Jamro. Optical fiber communications: principles and practice. Pearson Education, 2009.
4. De, Anuradha De. Optical Fibre and Laser: Principles and Applications. New Age International, 2003.
5. R.P. Khare, Fiber Optics and Optoelectronics. Oxford University Press, 2004

B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UIE611 **Paper name: Power Electronics** **Credit: 6**
Total contact hours: 36 **L-T-P: 3-0-0**

Module 1: **Contact hours: 08**

Power semiconductor devices: Introduction to power devices, Power diodes: General Purpose, Fast Recovery, Schottky Diode; Power transistors: BJT, MOSFET, IGBT, SIT, HEMT and their V-I characteristics; Thyristor: Introduction to SCR, DIAC, TRIAC, GTO, UJT, PUT, SCS, LASCR, SUS, MCT; SCR: Operating Principle, Gate Characteristics, Two-Transistor model, di/dt and dv/dt Protection, Firing circuits, series and parallel operation, rating, selection; Thyristor Triggering techniques; Thyristor Commutation techniques.

Module 2: **Contact hours: 04**

Phase Controlled rectifiers: single phase and three phase half-wave and full-wave (semi and full) controlled rectifiers with R, RL, RL with freewheeling diode and RLE loads; Performance parameters of single phase and three phase converters; Dual converters

Module 3: **Contact hours: 03**

Choppers: Principle of Operation; Control Strategies; Step-up, step-down and Step up/Step down choppers; Type A, B, C, D and E choppers; Multiphase choppers

Module 4: **Contact hours: 03**

Inverters: single-phase voltage source inverter; Force commutated Thyristor inverters; Three phase bridge inverters; PWM inverters; Current source inverters, Series and parallel inverters

Module 5: **Contact hours: 03**

AC voltage controllers: Principle of phase control; Principle of integral cycle control; Single phase voltage controllers; Sequence control of AC voltage controllers.

Module 6: **Contact hours: 03**

Cycloconverters: Principle of Cycloconverter operation; Single phase to Single phase step up and step down cycloconverters; Three phase half wave cycloconverters.

Module 7: **Contact hours: 06**

DC and AC power supplies: Switched mode DC and AC power supply; Resonant DC and AC power supply; Bidirectional DC and AC power supply; UPS.

Module 8: **Contact hours: 06**

DC and AC drives: Single and Three phase DC drives; DC-DC converter drives; Closed loop control of DC drives; Induction motor drives; Closed loop control of Induction motors; Vector control; Synchronous motor drives; Stepper motor control.

Books/ References:

1. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd ed., Pearson Education, Delhi, 2002
2. N. Mohan, T. M. Underland, and W. P. Robbins, Power Electronics: Converter, Applications and Design, John Wiley & Sons, New York, 1995
3. P. S. Bimbhra, Power Electronics, Khanna Publishers, New Delhi, 2002
4. G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K. Sinha, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 1996

B. Tech (6th sem) in Instrumentation Engineering Syllabus Details (July 2020 onwards)

Paper code: UIE612 **Paper name: Communication Engineering** **Credit: 6**
Total contact hours: 35 **L-T-P: 3-0-0**

Module 1: Amplitude Modulation **Contact hours: 08**

Need for Modulation, Amplitude Modulation – Generation of AM waves, Double Sideband Suppressed carrier systems (DSB-SC), Single side band modulation (SSB) – Vestigial side band modulation (VSM) - comparison of various AM systems, Demodulation of AM waves – Envelope Detectors.

Module 2: Transmitters and Receivers **Contact hours: 03**

AM Transmitters - Low level and High level transmitters – AM Receivers – TRF receiver, super heterodyne receiver

Module 3: Frequency Modulation **Contact hours: 07**

Introduction to angle modulation systems – Definitions for FM & PM – Narrow band FM – Wide band FM – FM Modulators - Direct method, Indirect Methods, FM Demodulators – Slope detector, Phase Difference Detectors

Module 4: Sampling Theory and Pulse Modulation **Contact hours: 04**

Sampling Theorem, Sampling Techniques, Analog Pulse Modulation Methods-Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation

Module 5: Waveform Coding Techniques **Contact hours: 06**

Pulse Code Modulation (PCM), Concept of Quantization, Quantizer, Uniform Quantizer, Quantization Noise, Signal to Quantization Noise Ratio, Non Uniform Quantization, Delta Modulation, Adaptive Delta Modulation, Differential Pulse Code Modulation

Module 6: Digital Multiplexers and Digital Baseband Transmission **Contact hours: 04**

Multiplexing-Frequency Division Multiplexing, Time Division Multiplexing, PAM/TDM Systems, Concept of Digital Multiplexers, Line Coding, Inter-symbol Interference, Eye Pattern.

Module 7: Digital Modulation Technique **Contact hours: 03**

Amplitude Shift Keying, Phase Shift Keying, Frequency Shift Keying, Differential Phase Shift Keying, Quadrature Phase Shift Keying, Minimum Shift Keying.

Books / References:

1. Kennedy, "Electronics of Communication Systems, McGraw Hill.
2. Roddy D. and Coolen J., Electronic communications, Prentice Hall of India P. Ltd.
3. Anokh Singh, "Principles of communication Engineering" – S.Chand & Co.
4. Principle of Communication System by H. Tub and D.L. Schilling
5. Modern Digital and Analog Communication Systems by B.P. Lathi
6. Introduction to Analog and Digital Communication by Simon Hykin.
7. Singh.R.P. Sapre.S.D, Communication Systems, Analog and Digital, McGraw Hill Pub. .
8. Communication Systems (Analog and Digital) by Sanjay Sharma
9. Communication Systems by Chandra Sekar (Oxford)

B. Tech (5th sem) in Instrumentation Engineering Syllabus Details
(July 2020 onwards)

Paper code: UIE671 **Paper name: Process Control Lab** **Credit: 2**
Total contact hours: 2 hours per week **L-T-P: 0-0-2**

LIST OF EXPERIMENTS:

Under construction

B. Tech (5th sem) in Instrumentation Engineering Syllabus Details
(July 2020 onwards)

Paper code: UIE672 **Paper name: Electronic Instrumentation Lab** **Credit: 2**
Total contact hours: 2 hours per week **L-T-P: 0-0-2**

LIST OF EXPERIMENTS:

Under construction

B. Tech (5th sem) in Instrumentation Engineering Syllabus Details
(July 2020 onwards)

Paper code: UIE681 **Paper name: Power Electronics Lab** **Credit: 2**
Total contact hours: 2 hours per week **L-T-P: 0-0-2**

LIST OF EXPERIMENTS:

Exp. No. 1: To study the V-I characteristics of a MOSFET.

Exp. No. 2: To study the V-I characteristics of an IGBT.

Exp. No. 3: To study the V-I characteristics of SCR to find its practical latching and holding currents.

Exp. No. 4: To study the V-I characteristics of Triac.

Exp. No. 5: To study the UJT Relaxation Oscillator.

Exp. No. 6: To study the RR/RC triggering of a SCR.

Exp. No. 7: To study the SCR based Half-wave/Full-wave rectifier with RR/RC/UJT oscillator triggering.

Exp. No. 8: To study the control rectifier with Resistive/Inductive/Capacitive load.

Exp. No. 9: To study the Step up/Step down choppers circuit.

Exp. No. 10: To study the Half/Full bridge inverter circuit.

Exp. No. 11: To study the AC/DC voltage regulator.

Exp. No. 12: To study the constant Voltage/Current regulator.