BACHELOR OF TECHNOLOGY

(Instrumentation & Control Engineering)

THIRD SEMESTER EXAMINATION

Code no	Paper	L	T/P	Credit
THEORY PAPERS				
ETIC 201	Circuits & Systems	3	1	4
ETIC 203	Instrumentation Engineering – I	2	0	2
ETIC 205	Electrical Machines	3	1	4
ETIC 207	Computer Programming & Computation Technique	3	1	4
ETIC 209	Analog Electronics	3	1	4
ETIC 211	Industrial Instruments – I	3	1	4
PRACTICAL / VIVA VOCE				
ETIC 251	Circuits & Systems Lab.	0	2	1
ETIC 253	Computer Lab.	0	2	1
ETIC 255	Analog Electronics Lab.	0	2	1
ETIC 257	Electrical Machines Lab	0	2	1
	TOTAL	**17**	**13**	**26**

w.e.f. session 2004 – 2005

BACHELOR OF TECHNOLOGY

(Instrumentation & Control Engineering)

FOURTH SEMESTER EXAMINATION

Code no	Paper	L	T/P	Credit
THEORY PAPERS				
ETIC 202	Display and Recording System	3	1	4
ETIC 204	Measurement and Instruments	2	1	4
ETIC 206	Control System – I	3	1	4
ETIC 208	Digital Instruments – II	3	1	4
ETIC 210	Industrial Instruments – II	2	0	2
ETIC 212	Analytical Instrumentation	3	1	4
PRACTICAL / VIVA VOCE				
ETIC 252	Instrumentation Engineering Lab.	0	2	1
ETEE 254	Measurement Lab.	0	2	1
ETIC 256	Control System Lab.	0	2	1
ETEC 258	Digital Electronics Lab.	0	2	1
	TOTAL	**17**	**13**	**26**

Paper Code: ETIC – 201 **L T**
Paper: Circuits & Systems **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Unit I

Signal: The unit step, unit impulse, unit ramp, sinusoidal and exponential functions, Periodic waveforms. Classification of signals and system modeling in terms of differential and difference equation for linear time invariant (I.TI) system.

Unit II

Laplace Transform: Applications of Laplace Transform to system Analysis. Waveform synthesis and Laplace Transform of complex waveform. Concept of Transformed impedance. Graph Theory and its applications.

Unit III

Network Theorems: Review of the Thevnin, Norton theorem in a.c. circuits, Reciprocity, Millman Theorem, Maximum Power Transfer Theorem, Tellegen's theorem. Network function, two port parameters, Interconnection of 2-port network.

Unit IV

Elements of Network Synthesis: Two elements kind one port network, Elementary two port network.

Books:-

1. Signals and Systems: A. V. Oppenheim, A. S. Willshy and S. H. Nawab: Prentice Hall
2. Engineering Network Analysis & Filter Design: Gopal G. Bhise, P. R. Chadha, D. C. Kulshre Sh: Umesh Publications

Reference:

1. Network Analysis – V. Valkenburg (Prentice – Hall India)
2. Engineering Circuits Analysis – William H. Hayt, JR. Jack E. Kemmerly (Tata McGraw Hill)
3. Network Syntheses: Van Valkenburg (Prentice – Hall India)
4. Circuit Theory (Analysis and Synthesis): A. Chakrabarti: Dhanpat Rai & Co.

Paper Code: ETIC – 203 **L T**
Paper: Instrumentation Engineering – I **2 0**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT-I

Basic Building Blocks Of Any Instrumentation System:

Scope and necessity of instrumentation. Names of important process variables their units. Building blocks of instrumentation system. Various testing signals. Controlling system and controllers. Display systems Analog and digital.

UNIT-II

Performance Characteristics Of Instruments:

Concept of time constant response time, natural frequency, damping coefficient. Order of Instruments. Step response of different orders of instrument systems.

UNIT-III

Display Methods:

Various indicating Method, integrating and recording methods and their combinations. Merits and Demerits of circular charts and strip chart recorders. Basics of printing devices. Scanning and data logging.

UNIT-IV

Instrument Selection:

Factors affecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability. Static and dynamic response. Environmental, effects. Calibration of instruments.

Errors :

Source and classifications of errors, remedial action grounding and guarding, precautions for error reduction, elimination.

Books:

1. Sawhney, A.K.,"A course in Electrical Measurement & Instrumentation", Dhanpat Rai & sons.
2. Murty,D.V.S.," Transducers & Instrumentation",Prentice Hall.

Reference:

1. W.Bollton," Instrumentation & Process Measurement".

Paper Code: ETIC – 205 **L T**
Paper: Electrical Machines **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT I

Basic Concept of Rotating Machines:

General working principles and constructional features, types of windings, generation of voltage, production of torque.

D. C. Machine:

Constructional features of generators and motors, commutator action, armature reaction, E.M.F. equation, classification of D.C. Generator and motors, characteristics and applications. Methods of speed control & staring of D.C. Motors.

UNIT II

Transformer:

Basic principle and construction, losses, transformer testing, efficiency and voltage regulation, auto transformers. Three phase transformer, three winding transformer.

Single Phase Motors:

Principle of working-double revolving theory, starting characteristics and application of single phase motor and universal motor.

UNIT III

Polyphase Induction Motors:

Constructional features, rotating field, principle of operation, equivalent circuit and phaser diagram, torque, maximum torque slip characteristics, no load and block rotor tests, equivalent circuit determination, method of starting and speed control.

UNIT IV

Synchronous Machines:

Salient pole and cylindrical rotor machines, synchronous generator, distribution and coil span factors, E.M.F. equation. Salient pole generator-phase diagram.

Synchronous motor – principal of working, phaser diagram, v-curves, starting. Synchronous condenser and power factor improvement.

Books:

1. I. J. Nagrath and D. P. Kothari, “Electrical Machines ”, “TATA Mc Graw Hill”
2. Fitzgerald, A. E., C.Kingslay & Umans “Electrical Machines”, “Mc Graw Hill”

Reference:

1. P. S. Bimbra Electrical Machines, “Dhanpat Rai Publishers”
2. Ashfaq Hussain: Electrical Machines - Dhanpat Rai

Paper Code: ETIC – 207 **L T**
Paper: Computer Programming & Computation Technique **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT I

Introduction to pointers in C, pointer arithmetic, dynamic memory allocation, memory allocation for 1-D and 2-D arrays, Null pointers.

UNIT II

Concept of structure, declaring and defining structures, structures as User defined data types (VDTs), Arrays as structure to / form function, operations using pointers, unions and bitfields.

UNIT III

File I/O in C, FILE structure, opening and closing a file, formatted and unformatted I/O in C. Use of standard libraries in C for string, data and time operation graphics, applications.

UNIT IV

Solution of linear simulations equations – Gauss elimination, Gauss – Isdan, LU-decomposition, matrix inversion, eigen value and eigenvectors, evaluation of maximum eigen value.

Solution of nonlinear algebraic equation, Bisection, Newton raphson and secant methods, convergence and error analysis.
Numerical solution of ODE using Runga-kutta, Euler's and Adam's method.

Books:

1. C Completer reference, Herbert Shildt, Mchero.
2. Krishanmooorthyy & Sen, "Numerical Algorithm" affiliated E-W press.

Reference:

1. Kerrigham & Rachie, "C Programming" PHI
2. T. J. Akai, "Applied Numerical methods for Engineers", John Woley.

Paper Code: ETIC – 209 **L T**
Paper: Analog Electronics **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT I

Semiconductor Diodes and Rectifiers:

Introduction, general characteristics, energy levels, extrinsic materials n & p type, ideal diode, basic construction and characteristics, DC & AC resistance, equivalent circuits, drift & diffusion currents, transition & diffusion capacitance, reverse recovery times, temperature effects, diode specifications, different types of diodes (zener, varator, schottky, power tunnel, photodiode & LED). Half wave & full wave rectifiers.

UNIT II

Bipolar junction transistor:

Introduction, Transistor, Construction, transistor operations, BJT characteristics, load line, operation point, leakage currents, saturation and cut off mode of operations Ebermall's model.

Bias stabilization:

Need for stabilization, fixed Bias, emitter bias, self bias, bias stability with resfpect ot variations in I_{CO}, V_{BE} & β, Stabilization factors, thermal stability.

UNIT III

Small signal amplifiers:

CB, CE, CC configurations, hybrid model for transistor at low frequencies, RC coupled amplifiers.

Field Effect Transistors:

Classification & characteristics, operating point, biasing, enhancement & depletion type MOSFETS.

UNIT IV

Operational Amplifier:

Ideal OPAMP, OPAMP stages, OPAMP Parameters, equivalent circuit, Ideal voltage transfer curve, open loop OPAMP configuration, closed loop OPAMP configuration, OPAMP applications: comparator, current sources, rectifiers, first and second order filters, summer, integrator, differentiators, clipper, clamper, waveform generators, instrumentation amplifier, log, antilog amplifier.

Books:

1. R. L. Boylested & L. Nashelsky, "Electronic Devices & Circuit Theory", Prentice Hall.
2. Sedra & Smith, "Microelectronic Circuits", OXFORD University Press.

Paper Code: ETIC – 211 **L T**
Paper: Industrial Instruments – I **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT I

Temperative Measurements :

Temperature measurement in an industry, seabeck effect, Peltier effect, Temperature scales and conversions. Advantage and limitations of Vapour filled thermometer, gas filled thermometer, Liquid filled thermometers, mercury in glass thermometer, Bimetallic thermometer, Pressure spring thermometer, thermistors, pyrometers, Thermocouple.

UNIT II

Level Measurements :

Importance of level measurement, Principle of working material of construction, advantage and limitation of instruments such as visual level indicators, ordinary float type using string and pulleys. Purge method of measuring level, Buoyancy method, Resistance probes for level measurement, Ultrasonic level measurement, Gamma ray level measurement, level limit switches, level measurement in pressure vessels, solid level measurement techniques.

Flow :-

Mechanical flow meters, primary meters, secondary meters, Interferential type, principle of operation, Rotating vane, propeller type.

UNIT III

Differential pressure meters :

Type, constructional features, working and applications, orifice plate, venturi tube, flow nozzle, pivot tube, different transducers, variable area flow meters, rotameters, Electromagnetic and ultrasonic flow meters, mass flow meters, target flow and turbine flow meters.

UNIT IV

Pressure :

Principle of measurement of absolute and gauge pressure. Unit of pressure and conversion, different type of manometers, Principles of working, bellows, Bordon, Capsule and diaphragm, Pressure switches, vacuum gauge, pirani gauge, calibration of pressure gauge, dead weight.

Humidity :

Absolute humidity, relative humidity, D.W. point, principle of instrument for measure of humidity.

Books:

1. Liptak, B.G.(E.d.),"Instrument Engineers Handbook",vol.I to III,MC Graw Hill.
2. Patranabis, D. "Principles of Industrial Instrumentation", Tata MC Graw Hill.

Reference:

1. Sawhney, A.K.,"A course in Electrical Measurement & Instrumentation", Dhanpat Rai & sons.

Paper Code: ETIC – 202 **L T**
Paper: Display & Recording System **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Unit I

Signal Transmission:

Elementary ideas of pneumatic and electric transmission, load line and R. F. telemetry, IEEE classification of telemetry different modulation techniques, multiplexing, time division, frequency division, de-multiplexing.

Unit II

Display Devices:

Electrical indicating instruments, digital instruments, LED, LCD, seven segment, dot matrix display, BCD to seven segment converters, BCD to dot matrix converters, decimal decoders, analog and digital storage devices, oscilloscopes (digital), digital signal analyzer, nixie tube.

Unit III

Recorders & Processing Systems

Servo recorders, magnetic tape recorders (analog and digital), specialized recorders (analog & digital), multi-point strip chart recorder. Analog signal processing, data loggers, sensor based digital systems, evolution of DCS & SCADA system, differences between CCU, SCADA & DCS System.

Unit IV

Engineering Data Acquisition

Digital Data acquisition, introduction to special function add on cards – resistance cards, input & output cards, counter, text & time of card & digital equipment construction with modular designing, Intelligent and programmable instruments using computers.

Books:

1. Thomas E. Kissell, "Industrial Electronics", 3rd Edition, PHI Publications.
2. Jones B.E., "Instrument Technology", Vol. 3, Butter Worth & C. Publishers, 1987.
3. Curtis Johnson, "Process Control Instrument".
4. Bouwens A.J., "Digital Instrumentation", M.C. Grawhill, 1984.

Paper Code: ETIC – 204 **L T**
Paper: Measurement & Instruments **2 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT-I

A.C. Potentiometer:

Theory and operation of coordinate and polar types A.C. Potentiometers Errors and Applications.

A.C. Bridges:

De Sauty Bridge, Low and high Voltage Schering Bridge, Anderson Bridge, Maxwell Bridge, Wein Bridge for frequency measurement, Residuals in Bridges, Use of Shielding in bridges, Wagner earth connection, C.R.O. and Head Phones as detectors.

UNIT-II

Instrument Transformers :

Construction, operation, errors in current Transformers, in Potential transformers, Compensation techniques for errors in current transformers, Potential transformers, Testing of current transformers, Absolute and comparison methods.

UNIT-III

Instruments And Meters :

Induction type instruments; Theory, operation, adjustments and calibration of single phase energy meter, Polyphase energy meter. Ampere Hour meters, Measurement of Volt-ampere and reactive voltamperes, Power Factor Meters, Frequency Meters, Synchroscopes, Phase sequence indicators.

UNIT-IV

Electronic Measurement Instruments :

Vacuum tube voltmeter, Transistor Voltmeter, General purpose Oscilloscopes, Triggered Sweep Oscilloscopes, Frequency and time measurement.

Books:

1. Sawhney, A.K.,"A course in Electrical Measurement & Instrumentation", Dhanpat Rai & sons.
2. Considine,"Instrumentation Handbook",MCGraw Hill.

Reference:

1. Cooper,"Instrumentation", Wiley Publishers.

Paper Code: ETIC – 206 **L T**
Paper: Control System – I **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT I

Input / Output Relationship:

Introduction to open loop and closed loop control systems, mathematical modeling and representation of physical systems (Electrical Mechanical and Thermal), derivation of transfer function for different of types of systems, block diagram & signal flow graph, Reduction techniques, Mason's Gain formula.

UNIT II

Time – Domain Analysis

Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants in unity feedback control systems, error criteria, generalized error constants, performance indices, response with P, PI and PID controllers.

UNIT III

Frequency Domain Analysis:

Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain, constant M & N circles, close loop frequency responses, from open loop response.

UNIT IV

Concept of Stability:

Asymptotic stability and conditional stability, Routh – Hurwitz criterion, Nyquist stability criterion, Root locus plots and their applications.

UNIT V

Compensation Techniques:

Concept of compensation, Lag, Lead and Lag-Lead networks, design of closed loop systems using compensation techniques, feedback compensation using P, PI, PID controllers.

Books:

1. B. C. Kuo, "Automatic control system", Prentice Hall of India
2. I. J. Nagrath & M. Gopal, " Control system Engineering New Age International"
3. S. P.Eugene Xavier, "Modern control systems", S. Chand & Company.
4. K. Ogata, "Modern control Engineering", Prentice Hall of India.

Reference:

1. Norman S. Nise, "Control systems Engineering" John Wiley & Sons (Asia) Singapore.
2. Raymond T. Stefani, Design of Feedback Control System, Oxford University Press.

Paper Code: ETIC – 208 **L T**
Paper: Digital Electronics **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT-I

Number Systems And Codes :

Number systems, binary number systems, octal number system, hexadecimal number system, signed & unsigned numbers, different types of codes, binary operations – addition, subtraction, multiplication division, 1s and 2s complement of a number.

Logic Circuits :

Introduction to Boolean algebra and Boolean variables, logical functions, using Karnaugh map and qutno macluskoy methods multiplexes, de multiplexes, encoders, address, subtractions, parity generators, parity checkers, code converter, flip-flops, JK flip-flops.

Registers and counters, introduction, series and parallel registers, synchronous and asynchronous counters, up and down counters, ring counters and mod counters.

UNIT-II

D/A And A/D Converters :

Introduction, weighted register D/A converter, binary ladder D/A converter, specification for D/A converter, parallel A/D converter. Successive approximation A/D converter, single & dual slope A/D converter. A/D converter using voltage to frequency conversion, A/D converter using voltage to time conversion counter type A/D converters.

UNIT-III

Semiconductor Memories :

Introduction, memory organization, classification and characteristics of memories, sequential memories, read only memories, read and write memories, content addressable memories, programmable logic arrays, charged coupled device memory.

UNIT-IV

Digital Logic Families :

Introduction, characteristics of digital ICs, resistor transistor logic, integrated injection logic, direct coupled transistor logic, code transistor logic and transistor logic, Emitter coupled logic, MOS logic, high threshold logic families.

Books:

1. R.P.Jain,"Digital Electronics".
2. Morris Manno, "Digital Electronics",Prentice Hall.

Paper Code: ETIC – 210 **L T**
Paper: Industrial Instruments – II **2 0**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT-I

Measurement Of Force And Torque :

Mass, weight and force, Measuring methods, Mechanical weighing systems, Elastic transducers, Ballistic weighing, Hydraulic and pneumatic system, Torque measurement, Transmission dynamometers, Combined force and moment measurement.

UNIT-II

Density Measurement :

Application and selection, liquid density – displacement and float type densitometry, hydrometer, hydrostatic denstiometry, miscellaneous denstiometer, oscillating denstiometer, radiation denstiometer, vibrating denstiometer, weighing a fixed volume & gas denstiometer.

UNIT-III

Moisture Measurement :

Various definitions including wet basis & dry basis. Principle moisture- sensing devices-including electrical conductivity methods, electric capacitance methods, aluminum oxide impendence sensors, radio frequency absorption, microwave absorption, combined microwave & gama absorption, infrared absorption meters. The relatively new vibrating quartz crystal moisture sensors.

UNIT-IV

Measurement Of Dimension, Displacement, Linear Velocity And Vibration :

Gauge blocks, surface plates, temperature problems, use of comparators, optical methods, use of optical flats & monochromatic light for dimensional comparison, the interferometer, long path interferometer, surface roughness, displacement transducer, vigromerter, accelerometers.

Books:

1. Sawhney, A.K.,"A course in Electrical Measurement & Instrumentation", Dhanpat Rai & sons.
2. Liptak, B.G.(E.d.),"Instrument Engineers Handbook",vol.I to III,MC Graw Hill.

Reference:

1. Patranabis,D."Principles of Industrial Instrumentation ",Tata MC Graw Hill.

Paper Code: ETIC – 212 **L T**
Paper: Analytical Instrumentation **3 1**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

UNIT-I

Absorption And Emission Spectroscopy:

Introduction, nature of e.m radiation, electro-magnetic spectrum, Nuclear spin behavior, electron spin behavior.

UNIT-II

Electron Spin Resonance Spectroscopy :

ESR spectrometer, ESR spectra, spin-spin splitting, quantitative analysis.

UNIT-III

Chemical Analysis of Surfaces :

On scattering spectrometry, secondary ion mass spectrometry, Anger emission spectroscopy, electron spectroscopy for chemical analysis.

Mass Spectrometers :

Introduction, components of mass spectrometers, resolution, types of mass spectrometers.

UNIT-IV

Gas Chromatography :

Theory of gas chromatography, working of gas chromatography, detectors, Applications of gas chromatography, gas-solid chromatography.

Books:

1. R.S.Khandpur,"Handbook of Bio-Medical Instrumentation",Tata Mc Graw Hill.
2. Cromwell,"Bio Medical Instrumentation",Prentice Hall.