C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Electronics & Communication Engineering
SEMESTER: - III **CODE**: - 4TE03EMT1
NAME – Engineering Mathematics - 3 (EMT)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			Total
											Internal		University	
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03EMT1	Engineering Mathematics - 3 (EMT)	04	00	00	04	03	30	1.5	70	3.0	---	---	---	100

Objectives:-

- To represent periodic functions in terms of infinite trigonometric series
- To solve higher order ordinary differential equations
- To solve linear partial differential equations of first and second order
- To learn Laplace transform technique
- To study the numerical methods to solve transcendental equations

Prerequisite:-Students should have a firm grasp elementary engineering mathematics offered in first and second semesters. The basic concepts of calculus and algebra must be clear.

Course Outline:-

Sr. No.	Course Content	Hours
1	**Fourier Series :** Periodic functions, Dirichlet's conditions, Trigonometric series, Euler's formulae, Fourier expansion of periodic functions with period 2π, Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods, half range Fourier series, Harmonic analysis.	10
2	**Laplace Transforms and Applications:** Definition of the Laplace transform, Inverse Laplace transform, Linearity property, First Shifting theorem, Laplace Transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Solution of Differential equations using Laplace Transform, Unit step function, Second shifting theorem, Dirac's delta function.	15
3	**Ordinary Differential Equations and Applications:** Linear differential equations of second and higher order: Higher order linear differential equations with constant coefficients, Complementary Function (C.F.), Short cut methods for finding Particular Integrals(P.I.), General method: [1/f(D)] r(x) method for finding particular integral, Wronskian, Solution by method of variation of parameters,Cauchy's Homogeneous linear differential equation, Legendre's Homogeneous linear differential equation, Modeling of Electric circuits.	15

4	**Partial Differential Equations and Applications:** Formation of PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Solution of PDE by direct integration, Linear PDEs with constant coefficients, Classification of second order linear PDEs, Applications of PDE: Separation of variables, Solution of Wave equation, Heat equation and Laplace equation.	**15**
5	**Numerical solution of Algebraic & Transcendental equation** Solution of algebraic and transcendental equations: Bisection method, Regulafalsi method, Secant method, Newton-Raphson method, rate of convergence	**05**

Learning Outcomes:

After the successful completion of the course, students will be able to

- express physical phenomenon in mathematical form
- represent periodic function as a series in terms of sine and cosine
- Solve differential equations by using tools like Laplace transform and Fourier series.
- To solve second order partial differential equations: wave equation, heat equation, laplace equation.

Teaching & Learning Methodology:

- Lecture method using standard teaching aids.
- Solving term assignments in tutorials.
- Quiz/Seminar/Expert lectures

Books Recommended:

1. Advanced Engineering Mathematics (8th Edition), E. Kreyszig, Wiley-India (2007).
2. Higher Engineering Mathematics – Vol. 2, Dr.K.R.Kachot, Mahajan Publ. house
3. Engineering Mathematics -Vol 2, by Baburam, Pearson.
4. Higher Engineering Mathematics, Thirty-fifth edition. B. S. Grewal, Khanna Publication.
5. Elementary Differential Equations (8th Edition), W. E. Boyce and R. DiPrima, John Wiley (2005).
6. Fourier series and boundary value problems, R. V. Churchill and J. W. Brown, McGraw-Hill (7th Edition -2006).
7. Numerical Methods, B. S. Grewal, Khanna Publ.

E-Resources:

1 http://www.wiley.com/college/mat/kreyszig154962/
2 http://en.wikipedia.org/wiki/Portal:Mathematics
3 http://www.online.math.uh.edu

C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Electronics & Communication Engineering
SEMESTER: - III **CODE**: - 4TE03AEL1
NAME – Advance Electronics (AEL)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			Total
											Internal		University	
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03AEL1	Advance Electronics (AEL)	04	00	02	06	05	30	1.5	70	3.0	30	20	---	150

Objectives:-

- To provide detail knowledge for the working of Transistor at Low Frequencies and at High Frequencies, different Amplifier, Power Circuits and Oscillators in electronics devices.

Prerequisites: -The fundamental knowledge of electronics and mathematics.

Course Outlines:-

Sr. No.	Course Contents	Hours
1	**Transistor at Low Frequencies:** Two-Port Devices and the Hybrid Model, Transistor Hybrid Model, h-Parameters, Analysis of a Transistor Amplifier Circuit Using h Parameters, Thevenin's and Norton's Theorems and Corollaries, Emitter Follower, Comparison of Transistor Amplifier Configurations, Simplified CE Hybrid Model, Simplified Calculations for the CC Configuration, FET Small-Signal Model, Low Frequency CS and CD Amplifiers.	**08**
2	**Transistor Biasing and Thermal Stabilization:** The operating point, bias stability, self bias or emitter bias, stabilization against variations in I_{CO}, V_{BE}, and β, general remarks on collector current stability, bias compensation, thermal runaway, thermal stability	**06**
3	**Transistor at High Frequencies:** Hybrid –pi CE Transistor Model, Hybrid –pi Conductance, Hybrid –pi Capacitances, Validity of Hybrid –pi Model, Variation of Hybrid –pi Parameters, CE Short-Circuit Current Gain, Current Gain with Resistive Load, Single-Stage CE Transistor Amplifier Response, Gain-Bandwidth Product, CS Amplifier at High Frequencies, CD Amplifier at High Frequencies.	**06**
4	**Multistage Amplifier:** Classification of Amplifiers, Distortion in Amplifiers, Frequency Response of an Amplifier, Bode Plots, Step Response of an Amplifier, Bandpass of Cascaded Stages, RC Coupled Amplifier, Low Frequency Response of an RC Coupled Stage, Effect of an Emitter Bypass Capacitor on Low-Frequency Response, High-Frequency Response of Two Cascaded CE Transistor Stages, Multistage CE Amplifier Cascade at High Frequencies.	**08**
5	**Power Circuits and Systems:** Operating Point & Different types of amplifier, Class A large Signal Amplifiers, Second	**08**

	Harmonic Distortion, Higher –Order Harmonic Generation, Transformer Coupled Audio Power Amplifier, Efficiency, Push-Pull Amplifiers, Class B Amplifiers, Class AB Operation, Regulated Power Supplies, Series Voltage Regulator.	
6	**Operational Amplifiers:** Basic Operational Amplifier, Differential Amplifier, Emitter-Coupled Differential Amplifier, Transfer Characteristics of a Differential Amplifier, An Example of an IC Operational Amplifier, Offset Error Voltages and Currents, Temperature Drift of Input Offset Voltage and Current, Measurement of Operational Amplifier Parameters, Frequency Response of Operational Amplifiers.	**08**
7	**Feedback Amplifiers:** Classification of Amplifiers, Feedback Concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback Amplifiers, Input Resistance, Output Resistance, Method of Analysis of a Feedback Amplifier, Voltage Series Feedback, Current Series Feedback, Current Shunt Feedback, Voltage Shunt Feedback.	**08**
8	**Oscillators:** Positive feedback and Barkhausen Criterion , Sinusoidal Oscillators, Phase-Shift Oscillator, Resonant Circuit Oscillators, A General Form of Oscillator Circuit: Colpitts , Hartley's Oscillator, Wien Bridge Oscillator, Crystal Oscillators.	**08**

Learning Outcomes:-

- Explain clearly analysis of transistor at low and high frequency.
- Explain clearly multistage amplifiers, power amplifiers.
- Clear Basic concept about OPAMP and its circuit analysis
- Detailed understanding of different feedback amplifiers and oscillators.

Books Recommended:-

1. "Integrated Electronics", **Jacob Millman and Christos C. Halkias**, Tata McGraw Hill Publication.
2. "Principles of Electronics", **Mehta V. K. Mehta &Rohit**, S. Chand & Co. Ltd.
3. "Basic of Electronics", **De Debashis**, Pearson Education.
4. "Electronic Devices & Circuit Theory", **Boylestad Robert L. &Nashlesky Louis,** PHI Publication.
5. "Electronics Devices", **Thomas L. Floyd**, Pearson Education.
6. "Electronics Circuits- Discrete and Integrated" **Schilling Donald L. and BeloveE** , McGraw-Hill.

C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - III **CODE**: -4TE03DEL1
NAME – Digital Electronics (DEL)

Teaching &Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			Total
											Internal		University	
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03DEL1	Digital Electronics (DEL)	04	00	02	06	05	30	1.5	70	3.0	30	20	---	150

Objectives: -

- The objective of the subject is to provide detailed knowledge on different number systems and codes, logic circuits, logic families and types of memories.

Prerequisites: Basic knowledge of mathematics and electronic circuits.

Course Outlines: -

Sr. No.	Course Contents	Hours
1	**Number System and codes:** Decimal, Binary, Octal, Hexa-decimal number system, Conversion of numbers from one number system to other, complement method of subtraction, 1's and 2's complement method,.8421 BCD code, excess-3 code, Gray code, Binary to Gray conversion, Gray to Binary conversion, Parity bit and its importance in error detecting.	**10**
2	**Logic Gates and Boolean Algebra:** AND, OR, NOR, NOT, NAND, X-OR, Inhibit circuits, Axioms and laws of Boolean algebra, D'morgans theorem, Duality, Reduction of Boolean expression, converting AND/OR/INVERT logic to NAND/NOR logic.	**08**
3	**Simplification of Boolean expression:** Expansion of a Boolean expression to SOP and POS form, Minimization of POS and SOP expressions for 2 to 6 variables, K-Map: 2, 3, 4 Variable, Don't care conditions, Quine-Mcclusky methods.	**09**
4	**Combinational Logic:** The Half-adder, The Full-adder, The Half-subtractor, The Full-Subtractor, Parallel Binary Adders, The Look-Ahead Carry Adder, Two's Complement Addition And Subtraction Using Parallel Adders, Serial Adders, BCD adder, Binary Multipliers, Code converters, Parity bit Generators/Checkers, Comparators, Decoders, BCD to 7-Segment Decoders, Encoders, Priority Encoders, Multiplexers, Applications of Multiplexer, Demultiplexer	**10**
5	**Sequential Logic:** S-R Flip-flop, JK Flip-flop, D Flip-flop, T Flip-flop, Edge –Triggered Flip-flop, Master-slave Flip-flop, Applications of Flip-flops. Serial-in Serial-out Shift register, Serial-in Parallel-out Shift register, Parallel-in Serial-out Shift register, Parallel-in Parallel-out Shift register, Bi-directional shift register, Universal shift register, Applications of shift registers.	**10**

	Asynchronous counter, Design of Asynchronous counter, Synchronous counters, Design of Synchronous counter.	
6	**Logic Families:** Digital IC specification terminology, Logic families, TTL, Open collector gate, TTL subfamilies, IIL , ECL, MOS, CMOS, Dynamic MOS Logic	**07**
7	**Memories :** Memory types and terminology, Read Only memory, Semiconductor RAMs, Non-volatile RAMs, Sequential memories, Programmable logic Devices, Magnetic memories, Optical Disk memory, Charge coupled devices.	**06**

Learning Outcomes: -

After successful completion of the course students will be able to:

- Understand the various number systems and codes.
- Understand the basics of various digital circuits such as combinational and sequential logic circuits
- Understand different logic families such as TTL, DTL, ECL etc.
- Understand different types of memories.

Books Recommended:-

1. "Digital logic and computer Design", **M. Morris Mano**, PHI Publication
2. "Fundamentals of Digital Circuits", **A.Anandkumar**, PHI Publication
3. "Digital Electronics", **R.P.Jain**, TMH Publication
4. "Digital Electronics and Logic Design", **B. Somanathan Nair**, PHI publication

C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Electronics & Communication Engineering
SEMESTER: - III **CODE**: - 4TE03NAS1
NAME – Network Analysis (NAS)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			Total
											Internal		University	
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03NAS1	Network Analysis (NAS)	04	00	02	06	05	30	1.5	70	3.0	30	20	---	150

Objectives:-

- To impart the knowledge on passive circuit elements.
- To impart the knowledge on circuit solution by various methods such as network theorems, nodal and mesh analysis etc.

Prerequisites:-Basic knowledge of mathematics and physics.

Course Outlines:-

Sr. No.	Course Contents	Hours
1	**Circuit Elements and Energy Sources**: Circuit elements (R, L, C), series and parallel combination of each circuit elements, Energy sources, source transformation, star delta transformation, examples on them	**04**
2	**Analysis of Networks by Kirchhoff's law, Nodal Analysis and Mesh Analysis:** Kirchhoff's Current Law(KCL), Current division in parallel circuits, Kirchhoff's Voltage Law(KVL), Voltage division in series circuits, Nodal and Mesh analysis of electric circuits, examples on them	**07**
3	**Network Theorems:** Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem, Reciprocity theorem, Substitution Theorem, Compensation Theorem, Millman's Theorem, examples on them.	**06**
4	**Resonance and Selectivity:** **Series RLC Resonance:** Resonance properties, variation of R, L, C reactance with frequency, Q – factor, bandwidth and relation with each other, Selectivity and bandwidth, derivation of Half power frequencies, expressions of frequencies at which V_L and V_C are maximum, Effect of resistance on frequency response curve. **Parallel Resonance:**Resonance properties, variation of R, L, C susceptance, impedance and current with frequency, Q- factor, bandwidth, impedance, selectivity and relationship with each other, Examples on them	**06**
5	**Initial Conditions:** Initial conditions in elements, procedure for evaluating initial conditions, Examples on them	**06**
6	**Transient response of passive circuits (RL, RC and RLC circuits)**:	**06**

	Preamble of differential equation approach, transient response of RL, RC circuit with dc and sinusoidal excitation (first order circuit), transient response of RLC circuit with dc and sinusoidal excitation (second order circuit), examples on them.	
7	**Laplace Transform (LT) and its Application In Circuit Analysis:** LT of derivatives, integrals and common forcing functions, time displacement theorem, initial and final value theorem, convolution, Application of LT techniques in passive circuits, partial fraction expansion method, step response of series RL, RC circuits, step current response of parallel RL, RC circuits, impulse response of series RL, RC circuits, response of series RL, RC circuits with pulse input, step response of series RLC circuit, step current response of parallel RLC circuit, examples on them **Analysis of special signal waveforms:** Basic types of special signals, LT of special signal waveforms, Gate function, examples on them	**07**
8	**Two port networks:** Relationship between two port variables, short circuit admittance parameters, open circuit impedance parameters. Transmission parameters, Hybrid parameters, Relationship between parameter sets. Parallel, series connections and cascading of two port networks, examples on them	**06**
9	**Network Functions:** Concept of complex frequency Network, Functions for one part and two part network, poles and zeros of network function. Time domain behaviour from poles and zero plot, examples on them	**06**
10	**Introduction to Graph Theory**: Concept of network graph, terminology used in network graph, relation betweenTwigs and Links, properties of tree in a graph, formation of incidence Matrix[Ai], number of trees in agraph, tie set matrix, fundamental tie-set matrix, fundamental of cut-set, cut-set matrix[Qa], KVL and KCL in to topological form, examples on them.	**06**

Learning Outcomes:-

- Upon successful completion of this subject, students should:
  * be able to identify various passive circuit elements.
  * be able to find out the solution of the circuit by various methods.
  * be able to understand two port networks.

Books Recommended:-

1. "Circuit theory analysis and synthesis', **A. Chakrabarti**, Dhanpatrai and Co.
2. "Network Analysis", **M.E Van Valkenburg**, PHI Publication.
3. "Network Analysis", **G. K. Mihal**, Khanna Publication
4. "Electric Circuits and Networks",**K. S. Suresh Kumar**, Pearson Education
5. "Engineering Circuit Analysis", **W H Hayt, J E Kemmerly, S M Durbin**, 6th Edition, TMH Publication

C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Technology&Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - III **CODE**: -4TE03ELM1
NAME –Electronics Measurement (ELM)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			
											Internal		University	Total
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03ELM1	Electronics Measurement (ELM)	04	00	02	06	05	30	1.5	70	3.0	30	20	---	150

Objectives:-

- To enable the students to understand the principles and circuits of basic measuring instruments, oscilloscope, transducers and data acquisition system, by means of basic theoretical concepts.

Prerequisites: -Basic knowledge of basic electronicsand basic mathematics is essential.

Course Outlines:-

Sr. No.	Course Contents	Hours
1	**Quality of Measurements:** Introduction, Performance characteristics, static characteristics, errors in measurements, types of measurements, sources of errors, dynamic characteristics, statistical analysis, standard, electrical standard	**06**
2	**Display Devices and Basic Measuring Instruments:** Digital display system and indicator, Classification of displays, Display devices, LEDs, LCDs, Other displays, Ammeters: DC ammeter, Multi-range ammeter, Universal Shunt, Requirements of Shunt, Extending of ammeter ranges, Digital Voltmeter: Ramp technique, Dual Slope Integrating type DVM (Voltage-to-Time conversion), Integrating type DVM (Voltage-to-Frequency conversion), Principles of ADC, Successive approximations, Continuous Balance DVM, 3-1/2 Digit, Resolution, sensitivity and specifications of DVM, Microprocessor-based Ramp type DVM.	**10**
3	**Oscilloscope:** Basic principle, CRT features, Block diagram of oscilloscope, Simple CRO, Vertical amplifier, Horizontal deflecting system, Trigger sweep CRO, Trigger pulse circuit, Delay line in trigger sweep, Sync selector for continuous sweep CRO, Typical CRT connections, Dual beam CRO, Dual trace oscilloscope, Measurement of frequency and phase by Lissajous method, Basic measurement of capacitance and inductance, Applications of oscilloscope, Digital storage oscilloscope.	**10**
4	**Signal Generators:** Basic standard signal generator (Sine wave), Standard signal generator, Function generator, Square and pulse generator (Laboratory type).	**05**

5	**Wave Analyzers and Harmonic Distortion:** Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzer, Spectrum analyzer.	**05**
6	**Bridges:** Wheatstone's bridge, Kelvin's bridge, AC bridges, Capacitance and inductance comparison bridges,Maxwell's bridge, Hay's bridge, Wien's bridge.	**08**
7	**Transducers:** Electrical transducer, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermister, Inductive transducer, Differential output transducer, LVDT, Pressure inductive transducer, Capacitive transducer (Pressure), Load cell (Pressure cell), Piezo and Photo electric transducer, Photo-voltaic cell, Photo diode and photo transistor, Thermo electric transducer, Frequency generating transducer.	**10**
8	**Data Acquisition and Conversion:** Objective of DAS, Signal conditioning of the input, Single and multi channel DAS, Computer based DAS, D/A and A/D converters, Data loggers.	**06**

Learning Outcomes:-

- Upon successful completion of this subject, students should:
  * be able to understand various measuring instruments.
  * be able to understand different types of electrical transducers.
  * be able to know basic principles and internal circuits of oscilloscope.
  * have knowledge about data acquisition system.

Books Recommended:-

1 "Electronic Instrumentation", **H. S. Kalsi**, Tata McGraw Hill

2 "A Course in Electrical and Electronics Measurement and Instrumentation", **A. K. Sawhney**, DhanpatRai and Co. (Pvt.) Ltd.

3 "Transducer and Instrumentation", **D.V.S. Murty**, PHI

4 "A Course in Electrical and Electronics Measurement", **J. B. Gupta**, S. K. Kataria& Sons, Delhi, 2003

C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: -Technology&Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - III **CODE**: -4TE03EWS1
NAME –Electronics Workshop (EWS)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
							Theory				Practical (Marks)			Total
											Internal		University	
		Th	Tu	Pr	To		Sessional Exam		University Exam		Pr	TW	Pr	
							Marks	Hours	Marks	Hours				
4TE03EWS1	Electronics Workshop (EWS)	00	00	02	02	01	---	---	---	---	80	20	---	100

Objectives:-

- To enable the students to understand the different soldering techniques, fabrication of circuit on PCB, troubleshooting of circuits and testing

Prerequisites: -Basic knowledge of active and passive components, measuring instruments, signal generators, dc power supply is essential.

Course Outlines:-

Sr. No.	Course Contents	Hours
1	Soldering techniques, stripping and tinning standard wires, mountingcomponents- plated through hole and surface mount technology, hand wiresoldering, de-soldering techniques, electrostatic discharge.	**04**
2	**Analog Troubleshooting:** Electronics troubleshooting basics, troubleshooting with Oscilloscope,signal injection and signal tracing, system analysis, diagnostics methods,servicing close loop circuits, troubleshooting noise and intermittent.	**06**
3	**Digital Troubleshooting:** Introduction to troubleshooting digital logic, working with digital circuits and use of logic analysis system fortroubleshooting digital circuits.	**06**
4	**Study of Soldering Techniques and PCB Design :** Students are expected to select any experiment. Soldering and testing is tobe done for the selected experiment. Perform simulation of the sameexperiment by using CAD tools. Schematic as well as PCB design is to becarried out using CAD tools (OrCAD, Altium, Eagle, PowerPCB or others Package).	**04**
5	**Design, Simulation and Implementation of Analog/Digital/Mix Mode Project :** Students are expected to design any analog/digital/mix mode application oftheir choice. Perform simulation using software tools. PCB design,fabrication of PCB, testing and implementation should be done.Documentation of the project is to be done in standard IEEE format. Projectreport should include abstract in maximum 100 words, keywords,introduction, design, simulation, implementation, results, conclusion andreferences.	**10**

C.U.SHAH UNIVERSITY – WADHWANCITY

Learning Outcomes:-

- Upon successful completion of this subject, students should:
  * be able to understand troubling and testing of analog, digital and mix mode circuits
  * be able to understand designing PCB forcircuits.

Books Recommended:-

1 "SPICE for circuits and electronics using pSpice", Rashid M.H, Prentice Hall
2 "Printed Circuit Boards: Design and Technology", Bosshart, Tata McGraw Hill
3 Orcad/PCBII , "User's Guide".