COURSE GUIDE

1. Program info

1.1 Higher education institution	"Gheorghe Asachi" Technical University of Iaşi
1.2 Faculty / Department	Electronics, Telecommunications and Information Technology
1.3 Department	Telecommunications and Information Technologies
1.4 Field	Electronic Engineering, Telecommunications and Information Technologies
1.5 Study level	Bachelor
1.6 Study program / Qualification	Telecommunications Systems and Technologies

2. Course info

2.1 Course name	**ELECTRONICS TECHNOLOGY**					EBIS406	
2.2 Course organizer (lecturer)		Prof. Casian Botez Irinel					
2.3 Teaching assistants		Associate Prof. Damian Radu					
2.4 Year of study	IV	2.5 Semester	7	2.6 Assessment	Colloquium	2.7 Category	DI

3. Estimated total time (hours per semester for teaching activities)

3.1 Number of hours per week	4	3.2 lecture	2	3.3 seminar/laboratory	2
3.4 Total number of hours in curricula	56	3.5 lecture	28	3.6 seminar/laboratory	28

Time distribution	hours
Textbook, course support, references and course notes study	15
Library, electronic platforms and on site documentation	4
Seminar/laboratory preparation, homework, reports, portfolios and essays	10
Tutoring	7
Assessment	2
Other activities	2

3.7 Total individual study hours	40
3.9 Total hours per semester	96
3. 10 Number of credit points	4

4. Prerequisites (where applicable)

4.1 curricula type	-
4.2 competence type	-

5. Infrastructure (where applicable)

5.1. for lectures	video projector
5.2. for laboratories	Computer network, software (Orcad, Mathcad, Media player), etc.

6. Specific competences

Professional competences	• Students will cumulate theoretical and practical knowledge specific for the 'Electronics Technology' discipline • Presenting of the manufacturing technologies for printed circuit boards; technological stage details
Transversal competences	• Students training for an electrical scheme implementation at PCB level

7. Course targets (as resulting from **6. Specific competences** table)

7.1 Course main target	Students will cumulate theoretical and practical knowledge specific for the 'Electronics Technology' discipline
7.2 Course specific targets	• Students training for an electrical scheme implementation at PCB level

8. Contents

8. 1 Lectures	Teaching methods	Notes
1. Signal Integrity Is in Your Future (What Is Signal Integrity?, Signal Quality on a Single Net, Cross Talk, Rail-Collapse Noise, Electromagnetic Interference (EMI), Two Important Signal Integrity Generalizations, Trends in Electronic Products, The Need for a New Design Methodology, A New Product Design Methodology, Simulations, Modeling and Models, Creating Circuit Models from Calculation, Three Types of Measurements, The Role of Measurements, The Bottom Line)• PCB design tools 2. The Physical Basis of Transmission Lines (Forget the Word Ground, The Signal, Uniform Transmission Lines, The Speed of Electrons in Copper, The Speed of a Signal in a Transmission Line, Spatial Extent of the Leading Edge, The Instantaneous Impedance of a Transmission Line, Characteristic Impedance and Controlled Impedance, Famous Characteristic Impedances, The Impedance of a Transmission Line, Driving a Transmission Line, Return Paths, When Return Paths Switch Reference Planes, A First-Order Model of a Transmission Line, Calculating Characteristic Impedance with Approximations, Calculating the Characteristic Impedance with a 2D Field Solver, An n-Section Lumped Circuit Model, Frequency Variation of the Characteristic Impedance, The Bottom Line) 3. **Transmission Lines and Reflections** (Reflections at Impedance Changes, Why Are There Reflections? Reflections from Resistive Loads, Source Impedance, Bounce Diagrams,	Presentations, didactical movies	

Simulating Reflected Waveforms Measuring Reflections with a TDR, Transmission Lines and Unintentional Discontinuities, When to Terminate, The Most Common Termination Strategy for Point-to-Point Topology, Reflections from Short Series Transmission Lines, Reflections from Short-Stub Transmission Lines, Reflections from Capacitive End Terminations, Reflections from Capacitive Loads in the Middle of a Trace, Capacitive Delay Adders, Effects of Corners and Vias, Loaded Lines, Reflections from Inductive Discontinuities, Compensatio, The Bottom Line) 4. Lossy Lines, Rise-Time Degradation,and Material Properties (Why Worry About Lossy Lines? Losses in Transmission Lines Sources of Loss: Conductor Resistance and Skin Depth, Sources of Loss: The Dielectric, Dissipation Factor, The Real Meaning of Dissipation Factor, Modeling Lossy Transmission Lines, Characteristic Impedance of a Lossy Transmission Line, Signal Velocity in a Lossy Transmission Line, Attenuation and the dB, Attenuation in Lossy Lines, Measured Properties of a Lossy Line in the Frequency Domain, The Bandwidth of an Interconnect, Time-Domain Behavior of Lossy Lines, Improving the Eye Diagram of a Transmission Line, Pre-emphasis and Equalization, The Bottom Line). 5. **Cross Talk in Transmission Lines** (Superposition, Origin of Coupling: Capacitance and Inductance, Cross Talk in Transmission Lines: NEXT and FEXT, Describing Cross Talk, The SPICE Capacitance Matrix, The Maxwell Capacitance Matrix and 2D Field Solvers, The Inductance Matrix, Cross Talk in Uniform Transmission Lines and Saturation Length, Capacitively Coupled Currents, Inductively Coupled Currents, Near-End Cross Talk, Far-End Cross Talk, Decreasing Far-End Cross Talk, Simulating Cross Talk, Guard Traces, Cross Talk and Dielectric Constant, Cross Talk and Timing). 6. Differential Pairs and differential Impedance (Differential Signaling, A Differential Pair, Differential Impedance with No Coupling, The Impact from Coupling, Calculating Differential Impedance, The Return-Current Distribution in a Differential Pair, Odd and Even Modes, Differential Impedance and Odd-Mode Impedance, Common Impedance and Even-Mode Impedance, Differential and Common Signals and Odd- and Even-Mode Voltage Components, Velocity of Each Mode and Far-End Cross Talk, Ideal Coupled Transmission-Line Model or an Ideal Differential Pair, Measuring Even- and Odd-Mode Impedance, Terminating Differential and Common Signals, Conversion of Differential to Common Signals, EMI and Common		

Signals, Cross Talk in Differential Pairs, Crossing a Gap in the Return Path, To Tightly Couple or Not to Tightly Couple, Calculating Odd and Even Modes from Capacitance- and Inductance-Matrix Elements, The Characteristic Impedance Matrix,, The Bottom Line) **7. The Power Distribution Network (PDN)** (The Problem, The Root Cause, The Most Important Design Guidelines for the PDN, Establishing the Target Impedance Is Hard, Every Product Has a Unique PDN Requirement, Engineering the PDN, The VRM, Simulating Impedance with SPICE, On-die Capacitance, The Package Barrier, The PDN with No Decoupling Capacitors, The MLCC Capacitor, The Equivalent Series Inductance, Approximating Loop Inductance, Optimizing the Mounting of Capacitors, Combining Capacitors in Parallel, Engineering a Reduced Parallel Resonant Peak by Adding More Capacitors, Selecting Capacitor Values, Estimating the Number of Capacitors Needed, How Much Does a nH Cost? Quantity or Specific Values?)		

References
1. M. I. Montrose, "EMC and the printed circuit board: design, theory, and layout made simple", New York NY, IEEE, 1999, ISBN 078034703X.
2. Rao R. Tummala, Steve Chapman, "Fundamentals of Microsystems Packaging", McGraw-Hill Professional, 2001, ISBN 0071371699, 9780071371698.
3. Charles A. Harper, "Electronic packaging and interconnection handbook", McGraw-Hill Professional, 2004, ISBN 0071430482, 9780071430487.
4. Rao Tummala, "System on Package (SOP)", Ed. McGraw-Hill Professional, 2008, ISBN 0071459065 / 9780071459068.
5. Clyde F. Coombs, "Printed circuits handbook", sixth Edition, McGraw-Hill Professional, 2007, ISBN 0071467343, 9780071467346.
6. William J. Greig, "Integrated circuit packaging, assembly and interconnections", Springer, 2007, ISBN 0387281533, 9780387281537.
7. James E. Morris, Debendra Mallik, "Nanopackaging: Nanotechnologies and Electronics Packaging", Springer, 2007, ISBN 0387473254, 9780387473253.
8. James K. Wessel, "Handbook of advanced materials: enabling new designs", Wiley-IEEE, 2004, ISBN 0471454753, 9780471454755.
9. Mel M. Schwartz, "New materials, processes, and methods technology", CRC Press, 2006, ISBN 0849320534, 9780849320538.
10. Signal and Power Integrity - Simplified_2nd_Eric Bogatin_Prentice Hall PTR_2010

8. 2 Laboratory	Teaching methods	Notes
PCB design activity: CAD design of an electronic circuit: low voltage AC/DC power supply with over-current protection.	PCB design using ANSYS tools	

References
10. D. Ionescu, "Electronics Technology - circuit PCB design", on web: http://telecom.etc.tuiasi.ro/telecom/staff/dionescu/discipline%20predate/index.htm
11. M. I. Montrose, "Printed circuit board design techniques for EMC compliance: a handbook for designers", 2nd ed., New York, NY, IEEE; Wiley - Interscience, 2000, ISBN 0780353765.
12. Electronic components datasheets, available on web.
13. K. S. Kundert and O. Zinke, (2004), „The Designer's Guide to Verilog-AMS", Kluwer Academic Publishers, Boston, MA.

9. Course contents corroboration with the expectations of the epistemic community representatives, professional associations and relevant employers in the field of the program

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10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of final grade
10.4 Lectures	Practical implementation of an	Writing	60 %

	electrical scheme		
10.5 Seminar/laboratory	PCB design and Gerber files for manufacturing	Design presentation	40%
10.6 Minimum performance standard			
• characterization of a printed circuit board - structure and manufacturing			

Completion date
09.09.2019

Course organizer signature,
Prof. ~~Daniela IONESCU~~
CASIAN BOTEZ IRINEL

Teaching assistant signature,
Assoc. Prof. Radu Damian

Department approval date

16. SEP. 2019

Department director signature
Assoc. Prof. Luminița SCRIPCARIU, Ph.D