PROJECT 1.0101-0278

APPLICATION OF INTERDISCIPLINARY AND INTERNATIONAL TEAM AND PROJECT BASED LEARNING IN MASTER STUDIES

IN 557

DESIGN, OPTIMIZATION AND PROTOTYPING OF POWER TRANSFORMERS

COURSE ORGANIZERS

Lecturing:

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Prototyping:

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COURSE PROGRAM

INDIVIDUAL PREPARATION

Home preparation + Webinars + Feedback

W	Event	Preparation
42	First contact via e-mail	Engineering challenges: How do design a power transformer? Prepare your individual work plan.
43	Correspondence via e-mail preparing to hold a webinar	Course compendium (a complementary material to classical text books) & Design specifications
44	Correspondence via e-mail or/and a webinar	Design model of a power transformer, parameterization, sensitivity, analytic vs numeric model
45	Correspondence via e-mail or/and a webinar	Transformer characteristics, sensitivity analysis and optimization
46	Correspondence via e-mail or/and a webinar	Starting a course report

TEAM WORK

Design refinement + Prototyping

W	Time	Weekday: Mon-Tue-Wed-Thu-Fri				
47	08:00-09:30	Arrival & Accom-modation	Design model of a power transformer		Transformer design with RALE	(Theoretical) Preparations for building prototypes
	10:00-11:30			Transformer characteristics		
	12:00-13:30		Numeric field modelling			
	14:00-15:30	Presentation of preparations		Optimization of a power transformer		
	16:00-17:30					
48	08:00-09:30	Arrival to Vändra MS Balti Trafo	Making windings	Making windings and core	Assembling and testing	Testing
	10:00-11:30					
	12:00-13:30	(Practical) Preparations for building prototypes				
	14:00-15:30					
	16:00-17:30					Back to TUT
49	08:00-09:30		Handin report Preparing for presentation			
	10:00-11:30	Completing the course report, conclusions		Farewell		
	12:00-13:30		Presentations			
	14:00-15:30					
	16:00-17:30					

W – week number

To Michael and Rando

DESIGN SPECIFICATIONS

What to design, objectives and constrains, assembly (cooling) conditions, etc

MATERIAL DATA (PHYSICAL PROPERTIES)

Quantity	Symbol	Unit	Electromagnetic steel: option 1	Electromagnetic steel: option 2	Electromagnetic steel: option 3	Winding option 1	Winding option 2	Electrical insulation: option 1	Electrical insulation: option 2	Electrical insulation: option 3	
Cataloging name											
Permeability	$\mu_{r.max}$	-									
Coercivity	H_C	A/m									
Hysteresis loss coefficient	c_h	$JT^{-1}m^{-3}$									
Hysteresis loss exponent	e_h										
Eddy current loss coefficients	c_e										
Anomalous loss coefficients	c_a										
Stacking/filling factor		%									
Resistivity	ϱ	$\Omega \cdot m$									
Thermal resitivity coefficient	α	$1/^0K$									
Thermal conductivity (direct)	λ	W/mK									
Thermal conductivity (quad)	λ	W/mK									
Specific heat capacity	c	J/kgK									
Operation temperature	ϑ_{max}	^0C									
Relative permittivity, 20 ^0C	ε										
Electric breakdown voltage	U_{br}	V/m									
Price		€/kg									

MATERIAL DATA (GEOMETRICAL PROPERTIES)

1. Copper wire: diameter table of available electrical conductor
2. Electomagnetic steel: table of available grades and losses if loss coefficients are not specified
3. Insulation: table of available materials