MODULE HANDBOOK DESCRIPTION

Module designation	*High Fields Phenomena*	
Code	*FBA0010*	
Semester(s) in which the module is taught	*7/fourth year*	
Person responsible for the module	*Dr.rer.nat Teti Zubaidah, S.T., M.T.*	
Language	*Indonesian/English*	
Relation to curriculum	*Free-elective for Electrical Power System Engineering*	
Teaching methods	*lectures, small group discussion, case base method.*	
Workload (incl. contact hours, self-study hours)	Contact minutes every week, each week of the 16 weeks/semester: • Lectures (incl. on-site lectures): 2 x 50 minutes • Exercises and Assignments: 2 x 60 minutes • Independent study: 2 x 60 minutes. Total study hours = 5 hours 40 minutes/week.	
Credit points	*2 SKS (~ 3.2 ECTS)*	
Required and recommended prerequisites for joining the module	*Electromagnetics*	
Module objectives/intended learning outcomes	1. *Students are able to elaborate the concept of fields, wave, and electromagnetic spectrum.* 2. *Students are able to analyse high fields. phenomena over various electromagnetics frequency ranges.* 3. *Students are able to assess and compare the levels of electromagnetic exposures against applicable standards.* 4. *Students are able to connect high fields phenomena with environmental, health and legal aspects.*	*PLO3*

	5. *Students are able to plan the equipment, systems and resources needed to carry out an investigation of electromagnetic exposure in the laboratory.* 6. *Students are able to plan the equipment, systems and resources needed to carry out an investigation of electromagnetic exposure outdoors.*	*PLO4*
	7. *Students are able to measure and process electromagnetic data in the laboratory and outdoors.*	*PLO5*
Content	*This course studies high field phenomena with various views, both theoretical and practical aspects. Discuss several special topics regarding high-field phenomena that are relevant to technological developments, including issues related to the environment, health and law. The understanding of students will be greatly supported by project activities in measuring and processing data from samples in the laboratory and outdoors. Students will be guided to be able to assess and compare the level of electromagnetic exposure to applicable standards.* 1. *Brief of high fields phenomena* 2. *Electromagnetic frequency spectrum* 3. *High field phenomena at very low frequencies* 4. *High field phenomena at low frequencies* 5. *High field phenomena at high frequencies* 6. *High field phenomena at very high frequencies* 7. *Electromagnetic data acquisition and processing methods, and their interpretation* 8. *Discussion of special topics, including:* • *Electromagnetic exposure under HVAC* • *Electromagnetic exposure in the Substation* • *Electromagnetic exposure in the Solar Power Plant* • *Electromagnetic exposure from electronic and telecommunications equipment* • *Exposure to the Earth's magnetic field* • *Effects of electromagnetic exposure on plant growth* • *Effect of electromagnetic exposure on health* 9. *Legal aspects and disputes due to electromagnetic exposure*	
Examination forms	- *Written and oral case study* - *Midterm and final test*	
Study and examination requirements	*The final grade in the module is composed of:* *a. Activity assessment: 10%* *b. Case assessment: 55%* *c. Final project assessment: 35%* *Students must have a final grade of 65% or higher to pass*	

Reading list	1. *Butcher G., Mottar J., Parkinson CL., Wollack EJ. (2016) Tour of the Electromagnetic Spectrum 3rd ed., NASA, Washington DC.* 2. *Surkov V. and Hayakawa M. (2014) Ultra and Extremely Low Frequency Electromagnetic Fields, Springer.* 3. *IEEE Standards Coordinating Committee 28 (2002) IEEE standard for safety levels with respect to human exposure to electromagnetic fields, 0-3 kHz. New York, NY, IEEE - The Institute of Electrical and Electronics Engineers (IEEE Std C95.6-2002).* 4. *ICNIRP - International Commission on Non-Ionizing Radiation Protection (1994) Guidelines on limits of exposure to static magnetic fields. Health Phys, 66 100-106.* 5. *ICNIRP - International Commission on Non-ionizing Radiation Protection Health Physics Society (2009) Guidelines on limits of exposure to static magnetic fields.* 6. *ICNIRP - International Commission on Non-ionizing Radiation Protection (1998a). Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Phys, 74(4):494-522.* 7. *WHO - World Health Organization (2006) Environmental Health Criteria 232: Static Fields, ISBN 92-4-157232-9.* 8. *WHO - World Health Organization (2007) Environmental Health Criteria 238: Extremely Low Frequency Fields, ISBN 978-92-4-157238-5.* 9. *Mandea M. and Korte M. (2011) Geomagnetic Observations and Models. Springer Science+Business Media B.V.,* https://doi.org/10.1007/978-90-481-9858-0. 10. *Dubrov A. (1978) The Geomagnetic Field and Life, Springer US, doi: 10.1007/978-1-4757-1610-8.* 11. *Zubaidah T., Korte M., Mandea M., Hamoudi M. (2014), New insights into regional tectonics of the Sunda–Banda Arcs region from integrated magnetic and gravity modelling. Journal of Asian Earth Sci, 80 (5): 172-184.* 12. *Zubaidah T., Misbahuddin, Kanata B., Paniran, Rosmaliati, Yadnya MS., Riskia S. (2018) Earth Magnetic Fields Evolution over Nusa Tenggara Region from Declination and Inclination Changes on Lombok Geomagnetic Observatory, The 2nd International Conference on Applied Electromagnetic Technology (AEMT) 2018.* 13. *Kanata B., Zubaidah T., Paniran, Zainuddin A., Ramadhani C., Wiriasto GW., Akbar LASI., Riskia S. (2018) Earth Magnetic Fields Evolution over Nusa Tenggara Region from Intensity and Spectral Density Changes on Lombok Geomagnetic Observatory, The 2nd International Conference on Applied Electromagnetic Technology (AEMT) 2018.*