COURSE DESCRIPTION CARD - SYLLABUS

Course name

THE ANALYSIS OF IMPACT OF ELECTRIC AND MAGNETIC FIELDS ON NATURAL ENVIRONMENT

Course

Proposed by Discipline

Environmental engineering, mining and energy

Year/Semester

II/3

Type of studies

Doctoral School

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

4

Tutorials

Projects/seminars

Number of credit points

1

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Knowledge: he/she knows fundamental principles concerning electrical engineering.

Skills: he/she can connect environmental conditions with human hazard.

Social competencies: he/she knows a role of natural environment on human health.

Course objective

The main objectives of the course is to obtain knowledge concerning the impact of artificial electric and magnetic fields on human health. Sub-objectives are as follows: fundamentals of natural electric and magnetic fields on earth, source of artificial electric and magnetic fields, impact on the fields on people, regulations and standards of allowable values of electric and magnetic fields, methods of measurements of the fields, the distributions of electric and magnetic fields stress, methods of reduction of artificial electric and magnetic fields.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows:
1) natural electric and magnetic fields on earth, which are elements of natural environmental, [P8S_WG/SzD_W01]
2) source of artificial electric and magnetic fields, which can have negative influence on people, [P8S_WK/SzD_W05]
3) allowable values of electric and magnetic fields in Poland and other countries. [P8S_WK/SzD_W06]

Skills

A PhD student who graduated from doctoral school can:
1) measure of electric and magnetic fields around their sources, [P8S_UW/SzD_U01]
2) use methods of reduction of electric and magnetic fields around high voltage overhead power lines. [P8S_UW/SzD_U03]

Social competences

A PhD student who graduated from doctoral school is ready to:
1) assess of impact of electric and magnetic fields on human health. [P8S_KK/SzD_K01]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W05, W06	elaboratoion of the problem in writing form	student has to complete at least 50% of points of elaboration
U01, U03	elaboratoion of the problem in writing form	student has to complete at least 50% of points of elaboration
K01	elaboratoion of the problem in writing form	student has to complete at least 50% of points of elaboration

Programme content

1. Fundamentals concerning electric and magnetic fields (Natural electric and magnetic fields on earth (their sources), Natural electric and magnetic fields on other planet of solar system, Sources of artificial electric and magnetic fields, Impact of electric and magnetic fields on people, Methods of measurements of electric and magnetic fields, Electric and magnetic fields stress distributions around high voltage lines).
2. Allowable electric and magnetic fields (Criteria of estimation of allowable values of electric and magnetic fields, Allowable values of the fields in Poland, Allowable values of the fields on other countries).
3. Methods of reduction of artificial electric and magnetic fields stress (Application of multi-channels and multi voltages lines, Optimal phase configuration, Application of grounded conductors, Application of multi-phase and coaxial phase structure, Maximal decrease of distance between phase conductors, Location of phase conductors on high height, Application of DC lines instead of AC lines, Application of grounded things).

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

1. Analysis of electric field during insulators exchange on working high voltage 220 kV line in aspect of human hazard, By: Nadolny Zbigniew; Rakowska Aleksandra, Conference: 14th International Symposium of COMPEL on Electromagnetic Fields in Electrical Engineering (ISEF 09) Location: Univ Artois, Labs Elect Syst & Environm, Arras, FRANCE Date: SEP 10-12, 2009 , Sponsor(s): Univ Arras; Tech Univ Lodz, Inst Mechatron & Informat Syst., Volume: 86, Issue: 5, Pages: 200-203, Published: 2010.

2. Analysis of magnetic field intensity around high voltage 220 kV cable, By: Grzybowski, Andrzej; Nadolny Zbigniew; Rakowska Aleksandra; et al., Volume: 86, Issue: 11B, Pages: 226-228, Published: 2010.

3. Analysis of electric and magnetic field intensity generated by overhead power distribution lines of high voltage in Poznan, By: Nadolny Zbigniew; Grzybowski Andrzej; Kasprzak Wojciech; et al., Volume: 86, Issue: 11B, Pages: 254-257, Published: 2010.

4. Analysis of electric field intensity during live maintenance on 400 kV overhead power transmission line, By: Lopatkiewicz Radoslaw; Nadolny Zbigniew; Rakowska Aleksandra, Volume: 86, Issue: 11B, Pages: 258-261, Published: 2010.

5. Electric and magnetic field under various parts of multi-channel overhead power line 400/220/110 kV, By: Kasprzak Wojciech; Nadolny Zbigniew, Volume: 84, Issue: 10, Pages: 170-173, Published: 2008.

6. Reduction of electric field strength by two species of trees under power transmission lines, By: Zhou, Hongwei; Sun, Liping; Yang, Yang; et al., Volume: 29, Issue: 5, Pages: 1415-1422, Published: SEP 2018.

7. Phasing Effect on the Electric Fields Generated by High Voltage Overhead Power Lines, By: Salceanu Alexandru; Ursache Silviu; Asiminicesei Oana Maria; et al., Conference: 10th International Conference and Expositions on Electrical and Power Engineering (EPE) Location: Iasi, ROMANIA Date: OCT 18-19, 2018, Sponsor(s): Gheorghe Asachi Tech Univ Iasi, Fac Elect Engn; IEEE Romania Sect; IEEE; Setis; Fac Elect Engn Iasi, Graduates Assoc 2018 INTERNATIONAL CONFERENCE AND EXPOSITION ON ELECTRICAL AND POWER ENGINEERING (EPE) Book Series: International Conference and Exposition on Electrical and Power Engineering, Pages: 759-764, Published: 2018.

8. Electric Field Mitigation under Extra High Voltage Power Lines, By: Radwan R. M.; Mahdy A. M.; Abdel-Salam M.; et al. Volume: 20, Issue: 1, Pages: 54-62, Published: FEB 2013.

9. Magnetic fields from a scaled down model transmission line - Simulation and comparison to measurements, By: Rahman N. A.; Hussain H.; Said I.; et al. Conference: Asia-Pacific Conference on Applied Electromagnetics (APACE 2005) Location: Johor Bahru, MALAYSIA Date: DEC 20-21, 2005 Sponsor(s): Univ Teknol Malaysia, Dept Radio Commun Engn, Fac Elect Engn; Univ Teknol MARA, Microwave Technol Ctr; Kolej Univ Teknol Tun Hussein Onn, Ctr Electromagnet Compatibil; Kolej Univ Teknikal Kebangsaan Malasia; Kolej Univ Teknol Tunn Hussein Onn, Wireless & Radio Sci Ctr; IEEE Antennas & Propagat, Microwave Theory & Tech & Electromagnet Compatibil Joint Chapter APACE: 2005 ASIA-PACIFIC CONFERENCE ON APPLIED ELECTROMAGNETICS, PROCEEDINGS, Pages: 147-151, Published: 2005.

10. Optimization of transmission line phase position for electromagnetic field mitigation in 3-phase systems, By: Elhirbawy MA; Jennings LS; Keerthipala WWL; et al. Conference: 7th IASTED International Multi-Conference on Power and Energy Systems Location: PALM SPRINGS, CA Date: FEB 24-26, 2003 Sponsor(s): Int Assoc Sci & Technol Dev; IEEE Power Elect Soc. POWER AND ENERGY SYSTEMS, PROCEEDINGS, Pages: 406-411, Published: 2003.

11. Long-term effects of 60-Hz electric vs. magnetic fields on IL-1 and IL-2 activity in sheep By: Hefeneider SH; McCoy SL; Hausman FA; et al. Volume: 22, Issue: 3, Pages: 170-177, Published: APR 2001.

12. Reduction of magnetic fields from electric power and installation lines By: Lindberg L; Volume: 145, Issue: 5, Pages: 215-221, Published: SEP 1998.

Additional

1. Methods of electric field intensity reduction under overhead electric power transmission lines of high voltage, By: Oleszkiewicz Pawel; Nadolny Zbigniew, Conference: 14th International Symposium of COMPEL on Electromagnetic Fields in Electrical Engineering (ISEF 09) Location: Univ Artois, Labs Elect Syst & Environm, Arras, FRANCE Date: SEP 10-12, 2009, Sponsor(s): Univ Arras; Tech Univ Lodz, Inst Mechatron & Informat Syst. Volume: 86, Issue: 5, Pages: 196-199, Published: 2010.

2. Calculation of Magnetic and Electric Field under OHL and its Reduction, By: Ehrenberger Jakub; Mueller Zdenek; Svec Jan; Conference: 8th International Scientific Symposium on Electrical Power Engineering (ELEKTROENERGETIKA) Location: Stara Lesna, SLOVAKIA Date: SEP 16-18, 2015 Sponsor(s): RWE Grp; Slovenska Elektrizacna Prenosova Sustava a s; ZSE; SLOVENSKE ELEKTRARNE; Enel; MENERT; SIEMENS; SAT Automat; ELCON Bratislava a s; World Energy Council PROCEEDINGS OF THE 8TH INTERNATIONAL SCIENTIFIC SYMPOSIUM ON ELECTRICAL POWER ENGINEERING (ELEKTROENERGETIKA 2015) Pages: 121-124, Published: 2015.

3. Magnetic field exposures for UK live-line workers, By: Dawson TW; Caputa K; Stuchly MA; Volume: 47, Issue: 7, Pages: 995-1012, Article Number: PII S0031-9155(02)29962-5, Published: APR 7 2002.

4. Impact of electromagnetic field management on the design of 500 kV transmission lines By: Farag AS; AlShehri A; Bakhashwain J; et al. Volume: 40, Issue: 3, Pages: 203-238, Published: MAR 1997.

5. MAGNETIC-FIELD REDUCTION USING HIGH PHASE ORDER LINES, By: STEWART JR; DALE SJ; KLEIN KW, Conference: 1992 WINTER MEETING OF THE POWER ENGINEERING SOC OF THE IEEE Location: NEW YORK, NY Date: JAN 26-30, 1992, Sponsor(s): IEEE, POWER ENGN SOC, Volume: 8, Issue: 2, Pages: 628-636, Published: APR 1993.

Breakdown of average student's workload

	Hours	ECTS
Total workload	10	1.0
Classes requiring direct contact with the teacher	4	0.5
Student's own work (literature studies, preparation for tutorials, project preparation) [1]	6	0.5

[1] delete or add other activities as appropriate