AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Code:	int.courses-021	Module name:	Electrical engineering		
Academic year:	2019/2020	Semester:	Spring, Fall	ECTS credits:	6
Programme:	AGH UST International Courses				
Course homepage:	http://intcourses.agh.edu.pl/	Lecture language:	English		
Responsible teacher:	dr inż. Dybowski Paweł (dybowski@agh.edu.pl)				

Module summary

The course is aimed at acquiring knowledge and skills in electrical engineering, familiarization with professional vocabulary and applying the acquired knowledge during practical exercises.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K001	Student is able to work in group and knows the importance of power system for economy and industry	Involvement in teamwork, Activity during classes, Execution of exercises, Completion of laboratory classes
Skills		
M_U001	Students know: how to use measurement devices, how to measure and calculate basic parameters of DC and AC circuits, how to measure and calculate basic parameters of 3-phase AC circuit, how measure and calculate parameters of transformer,	Execution of laboratory classes, Report, Completion of laboratory classes, Activity during classes
M_U002	Students know: how measure and calculate parameters and characteristics of induction motor, how measure and calculate parameters characteristics of synchronous machine, how the PWM converter works with induction motor, how measure and calculate parameters and characteristics of DC motor, how measure and calculate parameters and characteristics of 1-phase induction motors	Activity during classes, Report, Execution of laboratory classes, Completion of laboratory classes
Knowledge		

M_W001	Student has a basic knowledge about: laws in DC and AC circuits, electronic elements, systems of electricity production	Examination, Execution of laboratory classes
M_W002	Student has a basic knowledge about: control systems of electrical machines, actuators and measurement devices.	Examination, Report, Execution of laboratory classes, Completion of laboratory classes
M_W003	Student has a basic knowledge about: induction machines, synchronous machines, DC brushed and brushless motors, universal motors, special construction of electromechanical converters	Report, Completion of laboratory classes, Examination, Execution of laboratory classes

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
56	28	0	28	0	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Student is able to work in group and knows the importance of power system for economy and industry	-	-	+	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Students know: how to use measurement devices, how to measure and calculate basic parameters of DC and AC circuits, how to measure and calculate basic parameters of 3-phase AC circuit, how measure and calculate parameters of transformer,	-	-	+	-	-	-	-	-	-	-	-

M_U002	Students know: how measure and calculate parameters and characteristics of induction motor, how measure and calculate parameters characteristics of synchronous machine, how the PWM converter works with induction motor, how measure and calculate parameters and characteristics of DC motor, how measure and calculate parameters and characteristics of 1-phase induction motors	-	-	+	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student has a basic knowledge about: laws in DC and AC circuits, electronic elements, systems of electricity production	+	-	+	-	-	-	-	-	-	-	-
M_W002	Student has a basic knowledge about: control systems of electrical machines, actuators and measurement devices.	+	-	+	-	-	-	-	-	-	-	-
M_W003	Student has a basic knowledge about: induction machines, synchronous machines, DC brushed and brushless motors, universal motors, special construction of electromechanical converters	+	-	+	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	56 h
Preparation for classes	35 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	45 h
Examination or Final test	2 h
Contact hours	5 h
Summary student workload	163 h
Module ECTS credits	6 ECTS

Additional information

Module content

Lectures

1. Instantaneous power in electrical circuits. Active power. Voltage and current

Kirchhoff’s laws. Thevenin’s principle. DC circuits. (5h)
2. Magnetic circuits. Permanent magnets. Ampere’s law. 1-phase transformer. Saturation and hysteresis.(4h)
3. AC circuits. Active, reactive and apparent power. (2h)
4. Symbolic method. Phasor diagrams. Transient and steady state in R+L+C circuits. Series and parallel resonance. Laplace transform. (5h)
5. Three-phase circuits. Wye and delta configuration. Power in 3-phase circuits. (2h)
6. Measuring instruments. Ammeter, voltmeter and wattmeter for DC and AC applications. (2h)
7. Electromechanical energy conversion. Synchronous machines: motors and generators. Phasor diagram. Induction machine. Steady-state torque versus speed characteristics. Capacitor motor. Induction servo motor. Commutator machines. Series, shunt and separate excitation. AC commutator motors. Brushless DC motors. Stepper motors. (5h)
8. Power electronic elements. Static converters for speed adjustable drives.Speed and positions indicators. Resolvers. Encoders. Piezoelectric motors and actuators. (3h)

Laboratory classes

Measurements and calculations in DC circuit. (2h)
Implementation of Ohms Law and Kirchhoffs Laws. (2h)
Measurements and solving circuits in resonance conditions. (2h)
Measurements and calculations in AC circuit. Calculating of active power. (2h)
Measurements and calculations of power in 3-phase circuits. (2h)
Measurements and calculations of the transformer. (3h)
Measurements and analysis of induction machine properties, based on Kloss’s formula, work with PWM converter. (4h)
Measurements and analysis of synchronous machine. (4h)
Measurements and analysis of DC motors. (4h)
Measurements and analysis of universal motor. (3h)

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.
Laboratory classes: W trakcie zajęć laboratoryjnych studenci samodzielnie rozwiązują zadany problem praktyczny, dobierając odpowiednie narzędzia. Prowadzący stymuluje grupę do refleksji nad problemem, tak by otrzymane wyniki miały wysoką wartość merytoryczną.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

To receive a positive evaluation of laboratory exercises (Mlab) it is necessary to perform all (provided for in the schedule) laboratory exercises and obtain positive grades from passing reports of all laboratory exercises.
The mark (Mlab) is determined according to the scale of grades compliant with the Study Regulations and is determined on the basis of the arithmetic average of the marks of reports.
In the case of obtaining a negative grade, the possibility of improvement in the form of a correction test is predicted, the method of conducting will be determined with the lecturer.

The grade for the exam (Mexam) is determined according to the grading scale in accordance with the Study Regulations and is determined on the basis of the final test result.
In the case of a negative mark (Mexam), form of improvement will be determined n accordance with the Study Regulations .

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:
– Attendance is mandatory: No
– Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z syllabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.
Laboratory classes:
– Attendance is mandatory: Yes
– Participation rules in classes: Studenci wykonują ćwiczenia laboratoryjne zgodnie z materiałami udostępnionymi przez prowadzącego. Student jest zobowiązany do przygotowania się w przedmiocie wykonywanego ćwiczenia, co może zostać zweryfikowane kolokwium w formie ustnej lub pisemnej. Zaliczenie zajęć odbywa się na podstawie zaprezentowania rozwiązania postawionego problemu. Zaliczenie modułu jest możliwe po zaliczeniu wszystkich zajęć laboratoryjnych.

Method of calculating the final grade

Mlab – average mark of the laboratory reports
Mexam – mark of the exam
Mfinal – final mark

To obtain a positive final grade (Mfinal) it is necessary to obtain positive grades from all laboratory exercises (Mlab) and the test from the lecture (Mexam).

The final grade (Mfinal) is determined on the basis of the scale of grades specified in the Study Regulations and is determined according to the algorithm:
Mfinal = 0.5• Mlab+0.5• Mexam

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

Complementing the backlog due to absence from laboratory exercises can be compensated by performing exercises on the date of another student group, after consultation with the person conducting the lab exercises or on an additional date (provided in the schedule) designed to compensate backlogs. You can make up for only one laboratory exercise in the one term.

Complementing the backlog due to absence from lectures is compensated individually.

Prerequisites and additional requirements

Knowledge of English

Recommended literature and teaching resources

1. Erickson W.H. Nelson: Electrical Engineering. Theory and Practice. John Wiley & Sons, Inc. N.Y.
2. M. C. Kelley, B. Nichols: Introductory linear electric circuits and electronics. John Wiley & Sons, N.Y.
3. R. J. Smith, R. C. Dorf: Circuits Devices and Systems. John Wiley & Sons, Inc.
4. A. Hughes: Electric Motors and Drives – Fundamentals, Types and Applications. Oxford – Newnes.
5. B. K. Bose: Modern power electronics and AC drivers.Upper Saddle River – Prentice Hall.

Scientific publications of module course instructors related to the topic of the module

1. Dybowski P., Lerch T., Milej W., Rams W. Skwarczyński J.: Układy elektromechaniczne i transformatory – obliczenia i zadania, Wydawnictwa AGH, Kraków 2010
2. Influence of non-sinusoidal voltage supply on harmonic spectrum of stator currents of induction machines; Paweł DYBOWSKI; EPQU’03 : Electrical Power Quality and Utilisation : 7th international conference : September 17–19, 2003, Cracow, Poland
3. Badania laboratoryjne samowzbudnego generatora indukcyjnego; Paweł DYBOWSKI, Wacław ORLEWSKI; Przegląd Elektrotechniczny / Stowarzyszenie Elektryków Polskich. — 2012 R. 88 nr 5a, s. 234–237
4. Problems of practical diagnostics of induction machines in industry; Paweł DYBOWSKI, Witold RAMS, Jan RUSEK; Electrical Power Quality and Utilisation Journal. ISSN 1896-4672 . — 2008 vol. 14 no. 1 s.

79–83
5. Obliczenia polowe zjawisk cieplnych w maszynie z magnesami trwałymi; Waldemar MILEJ, Paweł DYBOWSKI; Przegląd Elektrotechniczny / Stowarzyszenie Elektryków Polskich. — 2012 R. 88 nr 6, s. 146–149.
6. Transient state operation of small-power commutator motors – possibilities of using tach generators; Zbigniew TERTIL, Paweł DYBOWSKI; EPQU ’99 : Electrical Power Quality and Utilisation : 5th international confernce : September 15–17,1999, Cracow
7.. Diagnostyka silnika indukcyjnego napędu wentylatora spalin; Paweł DYBOWSKI, Henryk KRAWIEC, Waldemar MILEJ; Maszyny Elektryczne : zeszyty problemowe. — 2014 nr 4 (104), s. 253–258
8. Dybowski P.: Preliminary results of automatic cage-state diagnosis. 43. Internationales Wissenschaftliches Kolloquium 21-24.09.1998 Ilmenau, 462-467
9. Diagnostyka silnika indukcyjnego z wykorzystaniem dostępnych napięć stojana; Paweł DYBOWSKI, Waldemar MILEJ; Napędy i Sterowanie. — 2013 R. 15 nr 3, s. 108–113
10. Pomiary mocy czynnej, napięć i prądów przy zasilaniu małych silników komutatorowych – możliwości powstawania błędów pomiarowych; Paweł DYBOWSKI, Zbigniew TERTIL; Maszyny Elektryczne : zeszyty problemowe ; ISSN 0239-3646. — 2000 nr 61 s. 153–158.

Additional information

Rules for participation in classes: according to the Study Regulations.