COURSE INFORMATION

School/ Faculty:	Power Engineering/Electrical Engineering	**Page:**	1 of 5
Program name:	SKEE		
Course code:	SKEE 4633	**Academic Session/Semester:**	2018/19 1
Course name:	ELECTRICAL MACHINES	**Pre/co requisite (course name and code, if applicable):**	Fundamentals of Electric power systems, SKEE 2423
Credit hours:	3		

Course synopsis	This course is an extension of the basic power and electric machine course, exclusively offered for the electrical engineering students. The course provides the fundamentals of electric machines, which are synchronous machines, induction machines and DC machines. The course begins with electromechanical energy conversion. Next, students are introduced to principle of operations, constructions and some analysis on steady state performance of the electric machines. The course also introduces special motors and their applications, which includes single-phase induction motors, stepper motors, switch reluctance machines and universal motors. At the end of the course student should be able to perform steady state analysis of electric machines and apply their knowledge to real world applications.			
Course coordinator (if applicable)	Nik Din Muhamad			
Course lecturer(s)	**Name**	**Office**	**Contact no.**	**E-mail**
	Nik Din Muhamad, Section 01 & 02	P07-222	019-7205776	nikd@utm.my
	Prof. Madya Dr. Awang Jusoh, Section 03 & 04	P05-206	019-7778217	awang@utm.my

Mapping of the Course Learning Outcomes (CLO) to the Programme Learning Outcomes (PLO), Teaching & Learning (T&L) methods and Assessment methods:

No.	CLO	PLO (CODE)	Weight (%)	Knowledge Profile, Complex Problem Solving & Complex Engineering Activities	*Taxonomies and **generic skills*	T&L methods	***Assessment methods

Prepared by: Name: Nik Din Muhamad Signature: Date: 4 September 2018	Certified by: Name: Prof. Madya Ir. Dr. Md Pauzi Abdullah Signature: Date:

CLO1	Apply fundamental knowledge of mathematics, physics, and circuit to find solution on problems in the electrical machines.	PLO1 (KW)	40	WK3	C3	Lecture, Active learning	T, Q, F
CLO2	Identify, formulate and investigate the steady state performance of the electrical machines.	PLO3 (THPA)	60	WK3	C4	Lecture, active learning.	T, Q, F

Refer * EAC Knowledge Profile (WK), Complex Problem Solving (WP), Complex Engineering Activities (EA)
Refer **Taxonomies of Learning and UTM's Graduate Attributes, where applicable for measurement of outcomes achievement
*** **Asg** – Assignment; **F** – Final; **HW** – Homework; **Pr** – Presentation; **PR** – Project; **Q** – Quiz; **T** – Test etc.

Details on Innovative T&L practices:

No.	Type	Implementation
1.	Active learning	Conducted through in-class activities

Weekly Schedule:

Week 1	**Chapter 1. Electromechanical Energy Conversion** Review of electromagnetism - Ampere's circuit law, Faraday's law, magnetic equivalent circuit.
Week 2	Singly-excited and doubly excited magnetic system, field energy and co-energy, mechanical force. Torque production in cylindrical machines.
Week 3	Principles of rotating machines – cylindrical machines. Motional emf and electromagnetic torque. Basic construction of rotating electric machines. Active Learning for doubly excited electromechanical system.
Week 4	**Chapter 2. DC Machines** Construction, armature and field windings, commutator action, armature reaction and its effect, inter-poles and compensating windings.
Week 5	DC Generators: Terminal characteristics of separately excited, shunt, series and compound. Analysis of steady state performance. Active Learning for the analysis of shunt DC generator under no load and full-load conditions.

Week 6	DC Motors: Torque-speed characteristics of separately excited, shunt, series and compound. Analysis of steady state performance. Active Learning for the analysis of shunt DC motor under no load and full-load conditions.
Week 7	Methods of speed control of DC Motors and starter. Speed control technique – Ward-Leonard, Controlled rectifier and Chopper. **TEST 1**
Week 8	Mid-Semester Break
Week 9	**Chapter 3. 3-phase Induction Machines** Construction, stator winding, rotating magnetic field, principles of operation.
Week 10	Development of equivalent circuit model, no-load and blocked rotor tests, Torque-speed characteristic derivation. Steady state performance analysis and power flow.
Week 11	Classes of induction machines. Speed control of induction motor. Starting of Induction Motors. Active Learning for the analysis of steady-state performance of induction motor.
Week 12	**Chapter 4. Synchronous Machines** Construction, cylindrical and salient poles, starting of synchronous motors, synchronous generators connection to infinite bus.
Week 13	Development of equivalent circuit. Open-circuit and short-circuit tests. Power factor control. Synchronous generator: Analysis of steady state performance. Active Learning for the analysis of steady-state performance of synchronous generator.
Week 14	Synchronous motor: Analysis of steady state performance, power and torque characteristics. Brushless DC (BLDC) Motors operation. **TEST 2**
Week 15	**Chapter 5. Special motors** Construction, working principles and starting of single phase induction machine. Working principles of stepper motors, switch reluctance machine and universal motors.

Transferable skills (generic skills learned in course of study which can be useful and utilised in other settings):

Analysis, Technical Writing Skill

Department/ Faculty:	Power Engineering/Electrical Engineering	**Page:**	4 of 5
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Course code:	SKEE 4633	**Academic Session/Semester:**	2018/19 1
Course name:	ELECTRICAL MACHINES	**Pre/co requisite (course name and code, if applicable):**	Basic Power and Electric Machines, SKEE2423
Credit hours:	3		

Student learning time (SLT) details:

Distribution of SLT by CLO	Teaching and Learning Activities								SLT
	Guided Learning (Face to Face) L – Lecture; T – Tutorial; P – Practical; Pr – Project; PBL/D – Problem Based Learning/Design; O - Others						Guided Learning Non-Face to Face	Independent Learning Non-Face to face	
CLO	**L**	**T**	**P**	**Pr**	**PBL/D**	**O**			
CLO1	17h						7h 30m	17h	**41h 30m**
CLO2	25h						12h	25h	**62h**
Total SLT	**42h**						**19h 30m**	**42h**	**103h 30m**

Continuous Assessment		PLO	Percentage	SLT
1	Test 1	KW, THPA	17.5	**1h 30m**
2	Test 2	KW, THPA	17.5	**1h 30m**
3	Quiz 1	KW	2.5	**20m**
4	Quiz 2	KW	2.5	**20m**
5	Quiz 3	KW	2.5	**20m**
4	Assignment 1	KW, THPA	2.5	**3h 20m**
4	Assignment 2	KW, THPA	2.5	**3h 20m**
5	Assignment 3	KW, THPA	2.5	**3h 20m**
Final Assessment			Percentage	Total SLT
1	Final examination	KW, THPA	50	**2h 30m**
Grand Total				**120h**

h: hours, m: minutes

Special requirement to deliver the course (e.g: software, nursery, computer lab, simulation room):

N/A

Learning resources:

Text book (if applicable)

P.C. Sen, Principles of Electric Machines and Power Electronics, 2nd Edition, John Wiley and Sons

Main references
N/A

Additional references

1. A.E. Fitzgerald, Charles Kingsly Jr., Stephen D. Umans: Electric Machinery, Sixth Edition, Mc Graw Hill, 2003
2. Stephen J. Chapman, Electric Machinery Fundamentals, 3rd Edition, Mc Graw Hill, 1999.
3. Jimmie J. Cathey, Electric Machines: Analysis and design, Mc Graw Hill, 2001

Online

Academic honesty and plagiarism:

Assignments are group activities. Copying of work (texts, simulation results etc.) from other students/groups or from other sources is not allowed. Brief quotations are allowed and then only if indicated as such. Existing texts should be reformulated with your own words used to explain what you have read. It is not acceptable to retype existing texts and just acknowledge the source as a reference. Be warned: students who submit copied work will obtain a mark of **zero** for the assignment and disciplinary steps may be taken by the Faculty. It is also unacceptable to do somebody else's work, to lend your work to them or to make your work available to them to copy.

Other additional information (Course policy, any specific instruction etc.):

Disclaimer: