COURSE INFORMATION

| School/Faculty: | Electrical Engineering/Engineering | Page: | 1 of 4 | |
|-----------------|---|--------|--|-------------|
| Program name: | Masters of Engineering (Electrical Power) | | | |
| Course code: | MKEP 1513 | Acaden | nic Session/Semester: | 2019/2020/2 |
| Course name: | Electronic Power Conversion | Pre/co | requisite (course name le_if applicable): | NA CI+ |
| Credit hours: | 3 | | | 5 5 |
| | | | | 10 |

| Course synopsis | This course basically relates to static p UPS system, which include UPS classif methods. The next topic introduces electronic systems. Key definitions and discussion related to regulation probl Models for control design are briefly int also highlighted in this course. Some discussed followed by the mitigation m control methods are covered quite e residential application of power conve applications of power converters. | ower converters ication, application the basic contro- concepts from fe- em and feedbaar roduced at the er- background or ethods. Active po- ktensively in this irters are dealt | applications. It ons, converter Il concepts in edback system the dot this topic. In harmonics so ower filter classi is course. Finally with for a com | begins with a topic on topologies and control the context of power theory are revisited for of power converters. Active power filtering is unces and effects are fications, concepts and , some industrial and plete picture on static |
|--------------------|---|---|---|---|
| Course coordinator | Assoc. Prof. Dr. Naziha Ahmad Azli | ~ 2 | X | ~ |
| Course lecturer(s) | Name | Office | Contact no. | E-mail |
| | AP. Dr. Naziha bt. Ahmad Azli | P16A-246 | 019-7773556 | naziha@fke.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 | Taxonomies/ | T&L methods | ***Assessment |
|-----|----------|--------------------------------------|--------------------------------------|---------------|---------------------------------|-------------------|-------------------|
| | | | | (%) | **generic skills | | methods |
| (| LO1 | Relate to the overall static power | PLO1 | 50 | C5 | Lecture, | T, F |
| | | converters applications, involving | (AKW) | | | project-based | |
| | | both open-loop and close loop | \sim | | 5 | learning | |
| | | operations. | U | AU. | | - | |
| | | | | | | | |
| (| CLO2 | Propose the solutions to electrical | PLO2 | 30 | C6 | Case-study | PRR, CSR |
| | | engineering problems related to | (RS) | · | | based | |
| | | power conversion systems based on | | | | learning, | |
| | | a given scenario. | 5 | | | project-based | |
| | +. (| | | | | learning | |
| 4 | CLO3 | Provide solutions in electrical | PLO4 | 10 | EM3 | Case-study | PRR, CSR |
| - N | | engineering problems with | (EM) | | | based | |
| | <u> </u> | responsibility. | | | | learning, | |
| | | | | | | project-based | |
| 1 | | \mathbf{O} | | | | learning | |
| (| CLO4 | Seek for new information related to | PLO6 | 10 | LL2 | Inquiry-based | Pr, R |
| | | static power converters application. | (LL) | | | learning | |
| | | | | | | | |
| | | ***T – Test; HW – Homework; Report | R; PRR – Project | t Report; CSF | R - Case-study Report | Pr – Presentation | n; F – Final Exam |

| Prepared by: | | Certified by: |
|--------------|------------------------------------|------------------------------------|
| Name: | Assoc. Prof. Dr. Naziha Ahmad Azli | Name: Dr. Jasrul Jamani bin Jamian |
| Signature: | ent | Signature: |
| Date: | 9 Feb. 2020 | Date: |

Please take note that this CL uses the previous MOE PLO

| School/Faculty: | Power Engineering/Electrical Engineering | Page: | 2 of 4 | |
|-----------------|---|-------------------|---|-------------|
| Program name: | Masters of Engineering (Electrical Power) | | | |
| Course code: | MKEP 1533 | Acaden | nic Session/Semester: | 2019/2020/2 |
| Course name: | Electronic Power Conversion | Pre/co and cod | requisite (course name le. if applicable): | NA |
| Credit hours: | 3 | | , | 0.1 |

Details on Innovative T&L practices:

| No. | Туре | Implementation | | | | | |
|-------|---------------------------|--|--|--|--|--|--|
| 1. | Project-based learning | Students in groups of 2 or 3 are assigned with a project which requires power electronics solutions involving design calculations and verification using P-Spice/MATLAB. A project report is required for submission. | | | | | |
| 2. | Case-study based learning | Students in groups of 2 or 3 are given a case-study related to power electronics which requires thorough analysis and proposed solutions with justification through literature or simulation study. A case-study report is required for submission. | | | | | |
| 3. | Inquiry-based learning | Each student is required to a conduct literature review on the latest development in power electronics applications. The findings are shared through presentation and short report submission. | | | | | |
| Weekh | Weekly Schedule: | | | | | | |
| | a) Int b) Cla | rroduction | | | | | |

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Weekly Schedule:

| M | - | • | 40 | 1 | -1 |
|----|---|---|-----|---|----|
| ** | 5 | 5 | N.3 | | |

Uninterruptible Power Sup

- Introduction a١
- Classification b)
- Applications c)
- d) Performance evaluatio
- Power factor correction e)
- Control techniques
- Converters for UPS applications
- Batteries for UPS h Project, Test 1

Weeks 5-7

Overview of Feedback Control for Converters al

- Regulation and control b)
 - Review of feedback control principles
 - Converter models for feedback
- Voltage-mode and current-mode controls for DC-DC converters d
 - Comparator-based control for rectifier systems
- Proportional and PI control applications Test 2

Week 9-12

Week 13 - 14

- Semester Brea ctive Power Filters
 - Harmonics definition, sources and effects
 - б١ Harmonics mitigation methods
 - Active power filter (APF) classifications c)
 - d APF control techniques
- Case-study
- Industrial and Residential Applications
- a)Induction heating
- b)Electric welding
- c)Space heating
- d)Air conditioning
- e)High-frequency fluorescent lighting
- Presentation

Please take note that this Cl uses the previous MQF PLO

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| Credit hours: | 3 | | | Q1+ |

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

Moral and professional ethics

Life-long learning and information management

Student learning time (SLT) details:

| Distribution | | | | Tea | ching and Learning Activit | ies | SLT |
|---------------------|----------|---------|-------|----------|----------------------------|----------------------|---------------|
| of Student Learning | Guided | Learn | ing | | Guided Learning | Independent Learning | |
| Time (SLT) by CLO | (Face to | Face |) | | Non-Face to Face | Non-Face to face | G |
| | L: Lectu | re, T: | Tutor | rial, P: | | | 53 |
| | Practica | l, O: (| Other | s | | | \mathcal{O} |
| CLO | L | Т | Ρ | 0 | | | |
| CLO1 | 21h | | | 7h | 8h | 23h | 59h |
| | | | | | | | |
| CLO2 | 0 | | | 7h | 8h | 14h | 28h |
| | | | | | | | |
| CLO3 | 0 | | | 5h | 0 | Zh | 12h |
| CLO4 | 0 | | | 2h | 0 | 14h | 16h |
| | 21h | | | 21h | 16h | 58h | 115h |
| | | | | | | | |

| No. | Continuous Assessment | PLO (Code) | Percentage | SLT |
|-----|-------------------------|-------------|------------|------------|
| 1 | Test 1 | PLO1 (AKW) | 5 | 1h15m |
| 2 | Test 2 | PLO1 (AKW) | 5 | 1h15m |
| 3 | Project | PLO1 (AKW) | 10 | As in |
| | | PLO3 (CTPS) | 5 | CLO2/CLO3 |
| | | PLO4 (EM) | 5 | (20h) |
| 4 | Case study | PLO1 (AKW) | 10 | As in |
| | | PLO3 (CTPS) | 5 | CLO2/CLO3 |
| | | PLO4 (EM) | 5 | (20h) |
| 5 | Presentation and Report | PLO6 (LL) | 10 | As in CLO4 |
| | G | | | (14) |
| | Final Assessment | | | |
| 1 | Final Examination | PLO1 (AKW) | 40 | 2h30m |
| | Total SLT | | 100 | 120h |

h: hours, m: minutes

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

Computer lab with P-Spice/MATLAB-Simulink

Learning resources:

Main references

A. Emadi, A. Nasiri & S. B. Bekiarov - Uninterruptible Power Supplies and Active Filters, CRC Press

P. T. Krein - Elements of Power Electronics, Oxford University Press Inc., 1998.

Additional references

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| Course name: | Electronic Power Conversion | Pre/co and coo | requisite (course name le. if applicable): | NA |
| Credit hours: | 3 | | | 0.1 |

Mohan, Undeland & Robbins, Power Electronics - Converters, Applications and Design, 3rd Edition, John Wiley & Sons, 2003.

Daniel W. Hart, Power Electronics, McGraw-Hill International Edition., 2011

Rashid, M.H., Power Electronics, Circuits, Devices and Applications, Pearson/Prentice Hall, 2004

http://elearning.utm.my

Academic honesty and plagiarism:

Assignments are individual tasks and NOT group activities (UNLESS EXPLICITLY INDICATED AS 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:

All teaching and learning materials associated with this course are for personal use only. The materials are intended for educational purposes only. Reproduction of the materials in any form for any purposes other than what it is intended for is prohibited.

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ONLINE LEARNING & TEACHING (L&T) PLAN

| School/Faculty: | Electrical Engineering/Engineering | Page: | 1 of 3 | |
|-----------------|---|--------|------------------------|-------------|
| Program name: | Masters of Engineering (Electrical Power) | | | |
| Course code: | MKEP 1513 | Acader | nic Session/Semester: | 2019/2020/2 |
| Course name: | Electronic Power Conversion | Pre/co | requisite (course name | NA |
| Credit hours: | 3 | | | \$5 X |
| | | | C | JN . 70 |

| REVIEW OF L&T ACTIVITIES TO INCLUDE ONLINE LEARNING | | | | | | |
|---|-----------|--------------|---|---|-------------------------|------------|
| Course learning | Guided | Guided | Online Learning hours | | | |
| outcome | Learning | Learning FTF | FTF | | | |
| | (from CI) | completed | Activities | Type of time spent | Estimated time | Total time |
| CLO1 - Relate to the overall static power converters applications, | 28 | 0 | CX 3 | 28 | , jil | |
| involving both open- loop and close loop operations. | | ple | Students read the book chapters/relevant reading materials for topics 1-4 | The time required to consume content | 4 mins x 150 pages | 10 hours |
| • 6 | 53 | COL | Students spent time following on average 40 screens of presentation videos for topics 1-4 | The average time on screen and the number of screens viewed. | 6 mins x 40 | 4 hours |
| MIS 2 | | ner | <i>Live session with students for Q&A on topics 1-4</i> | The time spent in synchronous live interaction | 1 hour x 10 sessions | 10 hours |
| F_{0} | 0 | | Live session with students to go through problem examples on topics 1-4 | The time spent in synchronous live interaction | 1 hour x 4 sessions | 4 hours |

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| CLO2 - Propose the solutions to electrical engineering | 7 | 0 | | 7 | | |
|--|----|-----|---|--|-------------------------|---------|
| problems related to power conversion systems based on a | | | | | | 0. |
| given scenario. | | | Students read the relevant reading materials based on the given project | The time required to consume content | 4 mins x 15 pages | 1 hour |
| | | | Students propose project solution as a team | The time required to discuss and prepare the proposed | 1 hour x 3 sessions | 3 hours |
| | | | 5 | solution at own arrangement | | |
| | | 10 | Live session with students to discuss on the project issues/ | The time spent in synchronous live | 30 mins x 6 sessions | 3 hours |
| | | npr | (project facilitation and monitoring) | | | |
| CLO3 - Provide solutions in electrical engineering problems with responsibility. | 50 | | NO30 | 5 | | |
| his r | | ner | Students propose project solution on the aspect of designing with responsibility as a team | The time required to discuss and prepare the proposed solution on the aspect of designing with responsibility at own arrangement | 1 hour x 3 sessions | 3 hours |
| | | | Live session with students to discuss the project on the aspect of designing with | The time spent in synchronous liveinteraction | 30 mins x 4 sessions | 2 hours |

Please take note that this Cl uses the previous MQF PLO

| | | | responsibility before and after proposal submission (project facilitation and monitoring) |
|--|---|---|--|
| CLO4 - Seek for new information related to static power converters application. | 2 | 0 | |
| | | | Live session with students to discuss the relevant activities in fulfilling this CLO and to present their findings. |

| | REVIEW OF ASSESSMENT PLAN | | | | | | |
|---|---------------------------|---|------------|------------|--|--|--|
| | Before (from CI) Revised* | | | | | | |
| | Continuo | us Assessment | Percentage | Total SLT | | | |
| 1 | Test 1 | Online Test 1 | 10 | 1h15m | | | |
| 2 | Test 2 | Online Test 2 | 10 | 1h15m | | | |
| 3 | Project | Project to include aspects covered in the | | As in CLO2 | | | |
| 4 | Case Study | Case Study (report to be submitted via e- | 30 | and CLO3 | | | |
| | | learning) | | (40 h) | | | |
| 5 | Presentation and Report | Video presentation and report to be | 10 | As in CLO4 | | | |
| | | submitted via e-learning | | (14 h) | | | |
| | Summative Assessment | | | | | | |
| 1 | Final Examination | FTF or online Final Examination | 40 | 2h30min | | | |
| | nis a there | | | | | | |

| Prepared by: | | Certified by: | |
|--------------|------------------------------------|---------------|------------------------------|
| Name: | Assoc. Prof. Dr. Naziha Ahmad Azli | Name: | Dr. Jasrul Jamani bin Jamian |
| Signature: | - Paris | Signature: | |
| Date: | 19 April 2020 | Date: | |