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| <p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p> |  | <p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p> |
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Power Quality

College: Engineering

Department: Electrical Engineering

First: Course Definition

1- Course Code : EE 645

2- Units: 3 credit Hrs.

3 – Semester:

4 -Prerequisite

5- Co-requisite

6- Location (if not on main Campus):

Second: Course Objectives

1. Review definitions and standards of common power quality phenomena.
2. Understand power quality monitoring and classification techniques.
3. Investigate different power quality phenomena causes and effects.
4. Understand different techniques for power quality problems mitigation.

Third: Course Specifications

| 1- Topics to be covered | | |
|---|-------------|-------|
| Subject | No of Weeks | Units |
| 1. Review of power quality definitions and standards | 2 | 6 |
| 2. Exploring different identification, classification, monitoring and measuring & localization techniques of problems | 3 | 9 |
| 3. Harmonic analysis methodology, mitigation techniques and case | 3 | 9 |

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| studies | | |
| 4. Short and long duration voltage variation phenomena; cause, effects, mitigation, case studies (voltage Sag, Swell and Interruptions, Transient Over-voltages, Voltage Flicker, Voltage Unbalance, Voltage Regulation) | 3 | 9 |
| 5. Typical wiring and grounding problems affecting power quality and its solution | 2 | 6 |
| 6. Distributed generation and power quality; operating conflicts and network interfacing | 2 | 6 |

2- Course components (Total hrs in the Semester): 45

| Lecture | Exercise or lab | Other |
|-----------|-----------------|-------|
| 45 | ---- | |

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired :

- Power quality definitions and standards
- Power quality classifications, monitoring, and measuring methods
- Harmonic mitigation techniques
- Long and short term voltage variations
- Grounding and power quality effects
- Distributed generation and power quality

ii) Teaching strategies to be used to develop that knowledge

- Lectures
- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, internet search, and reporting)

iii) Methods of assessment of knowledge acquired

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- **Quizzes:** to assess understanding of the course knowledge.
- **Assignment reports:** to assess ability to answer some comprehensive questions.
- **Midterm Exams:** to assess understanding of the course knowledge.
- **Final Exam:** to assess understanding of the course knowledge.

b- Cognitive (Intellectual) Skills

- i) Cognitive skills to be developed***
- The ability to analyze, and determine the PQ characteristics.
 - The ability to select the suitable component for a better PQ
 - The ability to control the PQ standards

- ii) Teaching strategies to be used to develop these cognitive skills***
- Lectures
 - Assignments, at home
 - Discussions in the Class
 - Case study Report (data collection, Internet search, and reporting)

- iii) Methods of assessment of students cognitive skills***
- **Quizzes:** to assess the ability to solve quickly some problems.
 - **Assignment reports:** to assess the ability to solve and analyze some comprehensive problems.
 - **Midterm Exams:** to assess the ability to discuss, analyze, and solve the associated problems.
 - **Final Exam:** to assess the intellectual skills such as analytical skills and ability to solve related problems.

c. Interpersonal Skills and Responsibility

- i) Description of the interpersonal skills and capacity to carry responsibility to be developed***
- Team work
 - Ideas development and sharing with others

- ii) Teaching strategies to be used to develop these skills***
- Assignments, at home
 - Discussions in the Class
 - Case study Report (data collection, Internet search, and reporting)-

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iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- **Unified reports and Seminars:** to assess the integration done by the student in a unified report and presentations.
- **Oral Group Exams:** to assess interactive and communication abilities.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Use of the internet search
- Technical report writing

ii) Teaching strategies to be used to develop these skills

- Assignments, at home
- Assignment Reports (data collection, Internet search, and reporting)

iii) Methods of assessment of students numerical and communication skills

- **Assignment Reports:** to assess technical report writing abilities.
- **Discussion Groups:** to assess interactive and communication abilities.-

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

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ii) Teaching strategies to be used to develop these skills-

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iii) Methods of assessment of student's psychomotor skills

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4- Student Assessment Schedule

| Serial | Assessment tool (test, group project, examination etc.) | Week due | Weight |
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| 1 | Quizzies | Weeks 1-15 | 5% |

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| 2 | Assignments | Weeks 1-15 | 5% |
| 3 | Group reports and seminars | Week 1-15 | 10% |
| 4 | Mid Term Exam1 | Week 6 | 15% |
| 5 | Mid Term Exam2 | Week 12 | 15% |
| 6 | Final Exam | Week 16 | 50% |

5- Student Support

6- Learning Resources

i) Essential Books (References)

1. R. Dugan, M. McGranaghan, S. Santoso and H. Beaty, Electrical Power System Quality, Second Edition, McGraw-Hill, 2002, ISBN 0-07-138622-X.
2. A. Ghosh and G. Ledwich, Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publications, 2002, ISBN 1-4020-7180-9
3. J. Arrillaga, B. Smith, N. Watson and A. Wood, Power System Harmonic Analysis, John Wiley, 1997, ISBN 0-471-97548-6.
4. E. Acha, V. Agelidis, O. Anaya-Lara and T.J. Miller, Power Electronics Control in Electrical Systems, Newnes, 2002, ISBN 0-7506-5126-1.

ii) Course Notes-

- Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students. computer-based programs/CD, professional standards/regulations

iii) Recommended Books

1. - J. Arrillaga, B. Smith, N. Watson and A. Wood, Power System Harmonic Analysis, John Wiley, 1997, ISBN 0-471-97548-6.
2. E. Acha, V. Agelidis, O. Anaya-Lara and T.J. Miller, Power Electronics Control in Electrical Systems, Newnes, 2002, ISBN 0-7506-5126-1.

iv) Electronic Books & Web Sites:

- Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students

v) Periodicals

- IEEE Trans on Power Systems

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- IEEE Trans on Power Delivery
- IJEPRS (power system research journal)

7- Course Evaluation and Improvement Processes

- i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching***
- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college.
 - Questionnaire,
 - Observing the students opinions recorded in the college student site
 - Appeal box

- ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department***
- Periodical review of the teaching methods by both the department council and the education affairs vice dean
 - Questionnaire,
 - Observing the students opinions recorded in the college student site

- iii) Processes for Improvement of Teaching***
- Evaluation of the course outlines by external staff member from outside the university
 - Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

- iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)***
- It is planned to.
 - 1- Check marking of a sample of student work by an independent faculty member
 - 2- Exchange periodically, and remark a sample of assignments with a faculty member in King Saud University (KSU)

- v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.***
- Review of the course objectives, outcomes and curriculum each 2 years
 - Consequently, actions are to be taken to improve the course delivery when necessary.
 - Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university)

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