3- Course Specification of: Automatic Reactive Power Compensation Course Code (PME5312)

I. General Information About the Course:

1.	**Course Title:**	**Automatic Reactive Power Compensation**			
2.	**Course Code and Number:**	**PME5312**			
3.	**Credit Hours:**	**Credit Hours**			**Total**
		Lecture	Practical	Seminar/Tutorial	
		3	-	-	*3*
4.	**Study Level and Semester:**	Second Semester			
5.	**Pre-requisites (if any):**	-			
6.	**Co-requisites (if any):**	-			
7.	**Program (s) in which the course is offered:**	MSc. in Electrical Power Engineering			
8.	**Language of teaching the course:**	English			
9.	**Study System:**	Courses & Thesis			
10.	**Prepared By:**	Assoc. Prof. Dr. Radwan M. AL Bouthigy			
11.	**Reviewed by:**	Dr.			
12.	**Date of Approval:**				

II. Course Description:

This course provides advanced concepts on Flexible ac Transmission Systems design, advanced STATCOM architecture and capabilities, as well as, System UPFC design. With growth and advancements in the field of electronics and power system, devices around in real-time are able to reactive power compensation in a better way than one can imagine. The future of FACTS systems lie in the advancement of technologies that enable faster compensation with high interwoven connections between different devices. Course covers, Reactive-Power Control in Electrical Power Transmission Systems, Principles of Conventional Reactive-Power Compensators, SVC Control Components and Models ,Concepts of SVC Voltage Control ,SVC Applications, Thyristor-Controlled Series Capacitor (TCSC) ,TCSC Applications, Coordination of FACTS Controllers , STATCOM, SSSCand UPFC. Throughout course projects & case study works, students develop their skills in MATLAB design and implementation.

III. Course Intended Learning Outcomes (CILOs):

Upon successful completion of **Advanced Power Electronics Course**, the graduates will be able to:

a1. Demonstrate understanding of the theory and practice of FACTS system operation and design.

a2. Explain in detail the challenges of sustainable design of STATCM / SSSC systems.

b1. Solve complex reactive power compensation problems by selecting and applying appropriate tools and techniques.

b2. Progress new ideas to improve the scientific literature in the power systems and drives field.

c1. Apply modern analysis, design and simulation tools of modern FACTS system.

c2. Diagnose other areas of knowledge jointly with other professions to arrive at a solution for complex reactive power compensation problems.

d1. Establish leadership, analytical and problem-solving skills appropriate to the FACTS sector with focus on drives improvement.

d2. Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of FACTS systems design and integration.

IV. Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs)

CILOs		PILOs
a. Knowledge and Understanding: Upon successful completion of **the Advanced Power Electronics and Drive Course**, the graduates will be able to:		**A. Knowledge and Understanding:** Upon successful completion of the **MSc. In Electrical power Engineering Program**, the graduates will be able to:
a1.	Demonstrate understanding of the theory and practice of FACTS system operation and design.	A1. Demonstrate in-depth understanding of the theory and practice of modern electrical power systems design and operation and system identification.
a2.	Explain in detail the challenges of sustainable design of STATCM / SSSC systems.	A3. Explain in detail the key considerations and challenges of sustainable design and development of modern electrical power system components.
b. Cognitive/ Intellectual Skills: Upon successful completion of the **Advanced Power Electronics and Drive Course,** the graduates will be able to:		**B. Cognitive/ Intellectual Skills:** Upon successful completion of the **MSc. In Electrical power Engineering Program,** the graduates will be able to:
b1.	Solve complex reactive power compensation problems by selecting and applying appropriate tools and techniques.	B1. Identify, formulate, and solve complex power engineering problems by selecting and applying appropriate tools and techniques.
b2.	Progress new ideas to improve the scientific literature in the power systems and drives field.	B2. Critically review the scientific literature for effective justification and support of results and decisions.
c. Professional and Practical Skills: Upon successful completion of the **Advanced Power Electronics and Drive Course,** the graduates will be able to:		**C. Professional and Practical Skills:** Upon successful completion of the **MSc. In Electrical power Engineering Program,** the graduates will be able to:
c1.	Apply modern analysis, design and simulation tools of modern FACTS system.	C1. Apply modern tools for research, computation, simulation, analysis, and design of modern power systems.
c2.	Diagnose other areas of knowledge jointly with other professions to arrive at a	C2. Recognize the interdisciplinary nature of technical problems and apply other areas of knowledge to the solution, and work

	solution for complex reactive power compensation problems.	with other professions to arrive at a solution for complex engineering problems.
d. Transferable Skills: Upon successful completion of the **Advanced Power Electronics and Drive Course,** the graduates will be able to:		**D. Transferable Skills:** Upon successful completion of the **MSc. In Electrical power Engineering Program,** the graduates will be able to:
d1.	Establish leadership, analytical and problem-solving skills appropriate to the power electronics sector with focus on drives improvement.	D1. Demonstrate leadership skills in the workplace, to function professionally in a globally competitive world, and to communicate engineering results effectively.
d2.	Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of power electronics systems design and integration.	D2. Realize the relevance of economics, ethics and teamwork to the profession.

V. Alignment of CILOs to Teaching and Assessment Strategies

a. Alignment of Knowledge and Understanding CILOs:

Knowledge and Understanding CILOs		Teaching Strategies	Assessment Strategies
a1.	Demonstrate understanding of the theory and practice of FACTS system operation and design.	▪ Lectures, ▪ Self-Learning Problems/Studies,	▪ Written Exam, ▪ Assignments.
a2.	Explain in detail the challenges of sustainable design of STATCM / SSSC systems.	▪ Lectures, ▪ Active learning.	▪ Written Exam, ▪ Assignments

b. Alignment of Intellectual Skills CILOs:

Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1.	Solve complex reactive power compensation problems by selecting and applying appropriate tools and techniques.	▪ Lectures, ▪ Independent Study, ▪ Brainstorming.	▪ Survey, ▪ Written Exam, ▪ Assignments
b2.	Progress new ideas to improve the scientific literature in the power systems and drives field.	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Brainstorming,	▪ Written Exam, ▪ Assignments.

c. Alignment of Professional and Practical Skills CILOs:

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	Apply modern analysis, design and simulation tools of modern FACTS system.	▪ Case Study, ▪ Simulation Exercises, ▪ Brainstorming, ▪ Presentations,	▪ Written Research Proposal, ▪ Thesis and Publication.
c2.	Diagnose other areas of knowledge jointly with other professions to arrive at a solution for complex	▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Brainstorming,	▪ Written Research Proposal, ▪ Thesis and Publication.

	reactive power compensation problems.	▪ Presentations,	

d. Alignment of Transferable (General) Skills CILOs:

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	Establish leadership, analytical and problem-solving skills appropriate to the FACTS sector with focus on drives improvement.	▪ Independent Study, ▪ Presentation, ▪ Publish Research Papers.	▪ Written Exam, ▪ Written Report.
d2.	Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of FACTS systems design and integration.	▪ Dissertation Defenses and Presentation, ▪ Independent Study, ▪ Presentation, ▪ Brainstorming, ▪ Publish Research Papers.	▪ Written Exam, ▪ Assignments, ▪ Written Report.

VI. Course Content

1. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
1	Introduction	▪ Electrical Transmission Networks ▪ Conventional Control Mechanisms ▪ Flexible ac Transmission Systems (FACTS) - Advances in Power-Electronics Switching Devices - Principles and Applications of Semiconductor Switches	1	3	a1,a2
2	Reactive-Power Control in Electrical Power Transmission Systems	▪ Reactive Power ▪ Uncompensated Transmission Lines ▪ Passive Compensation - Shunt Compensation - Series Compensation - Effect on Power-Transfer Capacity	1	3	b1,b2
3	Principles of Conventional Reactive-Power Compensators	▪ Synchronous Condensers ▪ The Saturated Reactor (SR) ▪ The Thyristor-Controlled Reactor (TCR) ▪ The Thyristor-Controlled Transformer (TCT). ▪ The Fixed Capacitor–Thyristor-Controlled Reactor ▪ The Thyristor-Switched Capacitor–Thyristor-Controlled ▪ Reactor (TSC–TCR)	1	3	a1,b1,b2
4	SVC Control Components and Models	▪ Measurement Systems ▪ Current Measurement ▪ Power Measurement.	1	3	a2,b1,b2

		▪ The Requirements of Measurement Systems ▪ The Voltage Regulator ▪ Gate-Pulse Generation ▪ Modeling of SVC for Power-System Studies			
5	Concepts of SVC Voltage Control	▪ Voltage Control ▪ Voltage Control by the SVC ▪ Advantages of the Slope in the SVC Dynamic ▪ Characteristic ▪ Influence of the SVC on System Voltage. ▪ Design of the SVC Voltage Regulator ▪ Effect of Network Resonances on the Controller Response ▪ Sensitivity to TCR Operating Point ▪ Methods for Improving the Voltage-Controller ▪ Response	1	3	a2,b2,c1,c2,d1
6	SVC Applications	▪ Increase in Steady-State Power-Transfer Capacity ▪ Enhancement of Transient Stability ▪ Augmentation of Power-System Damping ▪ Torque Contributions of SVC Controllers ▪ Design of an SVC PSDC ▪ Composite Signals for Damping Control ▪ SVC Mitigation of Subsynchronous Resonance (SSR)	1	3	a1,b1,d1
7	The Thyristor-Controlled Series Capacitor (TCSC)	▪ Series Compensation ▪ The TCSC Controller ▪ Operation of the TCSC ▪ The TSSC ▪ Analysis of the TCSC ▪ Capability Characteristics ▪ Harmonic Performance ▪ Response of the TCSC.	1	3	c1,c2,d1,d2

		▪ Modeling of the TCSC ▪ An Advanced Transient-Stability Studies Model			
8	**TCSC Applications**	▪ Open-Loop Control ▪ Closed-Loop Control ▪ Improvement of the System-Stability Limit ▪ Enhancement of System Damping ▪ Subsynchronous Resonance (SSR) Mitigation ▪ Voltage-Collapse Prevention ▪ TCSC Installations	**1**	**3**	**b1,b2,c1,c2**
9	Mid Term Exam	▪ All Topics	**1**	**3**	**a1,a2,b1,b2**
10	**Coordination of FACTS Controllers**	▪ Controller Interactions ▪ SVC–SVC Interaction ▪ SVC–HVDC Interaction ▪ SVC–TCSC Interaction ▪ TCSC–TCSC Interaction	**1**	**3**	**a1,a2,b1,c1,d2**
11	**The STATCOM**	▪ The Principle of Operation ▪ The V-I Characteristic ▪ Harmonic Performance ▪ Steady-State Model ▪ SSR Mitigation ▪ Dynamic Compensation	**2**	**6**	**a2,b2,c1,c2,d1,d2**
12	**The SSSC**	▪ The Principle of Operation ▪ The Control System ▪ Applications - Power-Flow Control - SSR Mitigation	**1**	**3**	**a2,b1,c1,c2,d1**
13	**The UPFC**	▪ The Principle of Operation ▪ Applications	**1**	**3**	**a1,b2,c1,c2,d1**

14	Case Studies	▪ FACTS for specific applications such as utility, domestic appliance, power system electric vehicle and industrial applications	1	3	a1,a2,b1,b2,c1,c2,d1,d2
15	Final Exam	▪ All Topics	1	3	a1,a2,b1,b2
Number of Weeks /and Contact Hours Per Semester			16	48	

2. Practical Aspect NA				
Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1	▪ None			
Number of Weeks /and Contact Hours Per Semester				

3. Tutorial Aspect:				
No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	None			
Number of Weeks /and Units Per Semester		15	30	

VII. Teaching Strategies:

Lectures,
Self-Learning,
Case Study,
Simulation Exercises,
Brainstorming,
Presentations,
Group/Individual Projects and Studies,

VIII. Assessment Methods of the Course:

Written Exam,
Assignments, including reports and presentations
Written Research Proposal.

IX. Tasks and Assignments:

No	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1	**Assignments:** **Assignment 1: Design and implementation of controlled STATCOM circuits using MATLAB tools** **Assignment 2: Design and implementation of SSSC circuits using MATLAB tools** **Assignment 3: Individual search assignments with following presentations**	Individual	14	5th, 10th, & 12th	a1, a2, b1, b2, c1, c2, d1, d2
2	**Mini/Major Project:** **Students works and submit their individual & group Projects using Web searching, High-Level Programming and simulation to design and implement FACTSapplications.**	Individual/ Group	16	From the 4th to 14th	a1, a2, b1, b2, c1, c2, d1, d2
3	**Project presentation & Case studies**	Individual/ Group	10	Work from the 4th to 14th weeks	a2, b1, b2, c1, c2, d1, d2
	Total Score		40	==	===

X. Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1	Assignments	4th to 14th	40	40%	a1, a2, b1, b2, c1, c2, d1, d2
3	Midterm Exam	8th	20	20%	a1, a2, b1, b2
4	Final Exam (Theoretical)	16th	40	40%	a1, a2, b1, b2
Total				100%	===

XI. Learning Resources :

1. Required Textbook(s) :

3. **M. H. Rashid, 2014, "Power electronics: circuits, devices, and applications," 4rd edition, Prentice Hall**
4. **R. Mohan Mathur,(2002), ''Thyristor-based FACTS controllers for electrical transmission systems'', 3rd Edition, A John Wiley & Sons, INC. Publication.**

2. Essential References:

5. **Cyril W. Lander, 1993, "Power electronics", 3rd edition, McGraw-Hill.**
6. **B. W. Williams, 1992, Power Electronics, Devices, Drivers, Application and Passive components**

7. Fang Lin Luo, Hong Ye, Muhammad Rashid, "Digital Power Electronics and Applications", 2005, Elsev USA
8. E. Acha, Power Electronics control in Electrical system, 1st , 2002, Newnes

3. Electronic Materials and Web Sites *etc.*

5. www.goelectricdrive.com/
6. www.electricmachinery.com/
7. www.goelectricdrive.com/
8. http://www.ece.tamu.edu/~empelab/

Journal :

IEEE Publisher

https://www.ieee.org

Elsevier Publisher

https://www.elsevier.org

Science Direct Publisher

https://www.Sciencedirect.com

• **الضوابط والسياسات المتبعة في المقرر Course Policies**	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
سياسة حضور الفعاليات التعليمية Class Attendance: **- يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك.** **- يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.**	**1**
الحضور المتأخر Tardy: **- يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.**	**2**
ضوابط الامتحان Exam Attendance/Punctuality: **- لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان** **- إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.**	**3**
التعيينات والمشاريع Assignments & Projects: **- يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها.** **- إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.**	**4**
الغش Cheating: **- في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.** **- في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.**	**5**
الانتحال Plagiarism: **– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك**	**6**
سياسات أخرى Other policies: **- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ**	**7**

Academic Year: ……....

Course Plan (Syllabus): Automatic Reactive Power Compensation

I. Information about Faculty Member Responsible for the Course:

Name	Assoc. Prof. Dr. Radwan M. AL Bouthigy	Office Hours					
Location &Telephone No.	775284933	SAT	SUN	MON	TUE	WED	THU
E-mail	radwan006@yahoo.com						

II. General information about the course:

	Course Title	Automatic Reactive Power Compensation			
2.	Course Code and Number	PME5312			
3.	Credit Hours	Credit Hours			Total
		Lecture	Practical	Seminar/Tutorial	
		3	-	-	3
4.	Study Level and Semester	Secondmester			
5.	Pre-requisites	Advanced Power Electronics			
6.	Co –requisite	-			
7.	Program (s) in which the course is offered	MSc. in Electrical Power Engineering			
8.	Language of teaching the course	English			
9.	Location of teaching the course	Faculty of Engineering			

II. Course Description:

This course provides advanced concepts on Flexible ac Transmission Systems design, advanced STATCOM architecture and capabilities, as well as, System UPFC design. With growth and advancements in the field of electronics and power system, devices around in real-time are able to reactive power compensation in a better way than one can imagine. The future of FACTS systems lie in the advancement of technologies that enable faster compensation with high interwoven connections between different devices. Course covers, Reactive-Power Control in Electrical Power Transmission Systems, Principles of Conventional Reactive-Power Compensators, SVC Control Components and Models ,Concepts of SVC Voltage Control ,SVC Applications, Thyristor-Controlled Series Capacitor (TCSC) ,TCSC Applications, Coordination of FACTS Controllers , STATCOM, SSSC and UPFC. Throughout course projects & case study works, students develop their skills in MATLAB design and implementation.

IV. Course Intended Learning Outcomes (CILOs):

Upon successful completion of the **Advanced power electronics and drives** course, graduate students will be able to:

a1. Demonstrate understanding of the theory and practice of FACTS system operation and design .

a2. Explain in detail the challenges of sustainable design of STATCM / SSSC systems.

b1. Solve complex reactive power compensation problems by selecting and applying appropriate tools and techniques.

b2. Progress new ideas to improve the scientific literature in the power systems and drives field.

c1. Apply modern analysis, design and simulation tools of modern FACTS system.

c2. Diagnose other areas of knowledge jointly with other professions to arrive at a solution for complex reactive power compensation problems.

d1. Establish leadership, analytical and problem-solving skills appropriate to the FACTS sector with focus on drives improvement.

d2. Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of FACTS systems design and integration.

V. Course Content:

1. Theoretical Aspect:

Order	Units	Sub Topics	Week Due	Contact Hours
1	Introduction	▪ Electrical Transmission Networks ▪ Conventional Control Mechanisms ▪ Flexible ac Transmission Systems (FACTS) - Advances in Power-Electronics Switching Devices ▪ Principles and Applications of Semiconductor Switches	1	3
2	Reactive-Power Control in Electrical Power Transmission Systems	▪ Reactive Power ▪ Uncompensated Transmission Lines ▪ Passive Compensation - Shunt Compensation - Series Compensation - Effect on Power-Transfer Capacity ▪	1	3
3	Principles of Conventional Reactive-Power Compensators	▪ Synchronous Condensers ▪ The Saturated Reactor (SR) ▪ The Thyristor-Controlled Reactor (TCR) ▪ The Thyristor-Controlled Transformer (TCT). ▪ The Fixed Capacitor–Thyristor-Controlled Reactor ▪ The Thyristor-Switched Capacitor–Thyristor-Controlled ▪ Reactor (TSC–TCR)	1	3
4	SVC Control Components and Models	▪ Measurement Systems ▪ Current Measurement ▪ Power Measurement. ▪ The Requirements of Measurement Systems ▪ The Voltage Regulator ▪ Gate-Pulse Generation ▪ Modeling of SVC for Power-System Studies	1	3
5	Concepts of SVC Voltage Control	▪ Voltage Control ▪ Voltage Control by the SVC ▪ Advantages of the Slope in the SVC Dynamic ▪ Characteristic ▪ Influence of the SVC on System Voltage. ▪ Design of the SVC Voltage Regulator	1	3

		▪ Effect of Network Resonances on the Controller Response ▪ Sensitivity to TCR Operating Point ▪ Methods for Improving the Voltage-Controller ▪ Response ▪		
6	**SVC Applications**	▪ Increase in Steady-State Power-Transfer Capacity ▪ Enhancement of Transient Stability ▪ Augmentation of Power-System Damping ▪ Torque Contributions of SVC Controllers ▪ Design of an SVC PSDC ▪ Composite Signals for Damping Control ▪ SVC Mitigation of Subsynchronous Resonance (SSR)	1	3
7	**The Thyristor-Controlled Series Capacitor (TCSC)**	▪ Series Compensation ▪ The TCSC Controller ▪ Operation of the TCSC ▪ The TSSC ▪ Analysis of the TCSC ▪ Capability Characteristics ▪ Harmonic Performance ▪ Response of the TCSC. ▪ Modeling of the TCSC ▪ An Advanced Transient-Stability Studies Model	1	3
8	**TCSC Applications**	▪ Open-Loop Control ▪ Closed-Loop Control ▪ Improvement of the System-Stability Limit ▪ Enhancement of System Damping ▪ Subsynchronous Resonance (SSR) Mitigation ▪ Voltage-Collapse Prevention ▪ TCSC Installations	1	3
9	Mid Term Exam	▪ All Topics	1	3
10	**Coordination of FACTS Controllers**	▪ Controller Interactions ▪ SVC–SVC Interaction ▪ SVC–HVDC Interaction ▪ SVC–TCSC Interaction ▪ TCSC–TCSC Interaction	1	3
11	**The STATCOM**	▪ The Principle of Operation ▪ The V-I Characteristic ▪ Harmonic Performance	2	6

		▪ Steady-State Model ▪ SSR Mitigation ▪ Dynamic Compensation		
12	**The SSSC**	▪ The Principle of Operation ▪ The Control System ▪ Applications - Power-Flow Control ▪ SSR Mitigation	**1**	**3**
13	**The UPFC**	▪ The Principle of Operation ▪ Applications	**1**	**3**
14	**Case Studies**	▪ FACTS for specific applications such as utility, domestic appliance, power system electric vehicle and industrial applications	**1**	**3**
15	Final Exam	▪ All Topics	**1**	**3**
Number of Weeks /and Contact Hours Per Semester			**16**	**48**

2. Practical Aspect

Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1	▪ None			
Number of Weeks /and Contact Hours Per Semester				

3. Training/ Tutorials/ Exercises Aspects:

Order	Tutorials/ Exercises	Week Due	Contact Hours
1	▪ None		
Number of Weeks /and Contact Hours Per Semester			

VI. Teaching Strategies:

Lectures,
Self-Learning,
Case Study,
Simulation Exercises,
Brainstorming,
Presentations,
Group/Individual Projects and Studies,

VII. Assessment Methods of the Course:

Written Exam,

Assignments, including reports and presentations

Written Research Proposal.

VIII. Tasks and Assignments:

No	Assignments	Individual /Groups	Mark	Week Due
1	**Assignments:** **Assignment 1: Design and implementation of STATCOM circuits using MATLAB tools** **Assignment 2: Design and implementation of SSSC circuits using MATLAB tools** **Assignment 3: Individual search assignments with following presentations**	Individual	14	5th, 10th, & 12th
2	**Mini/Major Project:** **Graduates works and submit their individual & group Projects using Web searching, High-Level Programming and simulation to design and implement FACTS applications.**	Individual/ Group	16	From the 4th to 14th
3	**Project presentation & Case studies**	Individual/ Group	10	Work from the 4th to 14th weeks
	Total Score		40	

IX. Learning Assessment:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment %
1	**Assignments**	4th to 14th	40	40%
3	**Midterm Exam**	8th	20	20%
4	**Final Exam (Theoretical)**	16th	40	40%
	المجموعTotal		100	100 %

X. Learning Resources:

1. Required Textbook(s) :

1. M. H. Rashid, 2014, “Power electronics: circuits, devices, and applications,” 4rd edition, Prentice Hall
2. R. Mohan Mathur, (2002), ‘’Thyristor-based FACTS controllers for electrical transmission systems’’, 3rd Edition, A John Wiley & Sons, INC. Publication.

2. Essential References:

1. Cyril W. Lander, 1993, “Power electronics”, 3rd edition, McGraw-Hill.
2. B. W. Williams, 1992, Power Electronics, Devices, Drivers, Application and Passive components
3. Fang Lin Luo, Hong Ye, Muhammad Rashid, "Digital Power Electronics and Applications", 2005, Elsev USA
4. E. Acha, Power Electronics control in Electrical system, 1st , 2002, Newnes

3. Electronic Materials and Web Sites etc.

1. www.goelectricdrive.com/
2. www.electricmachinery.com/
3. www.goelectricdrive.com/
4. http://www.ece.tamu.edu/~empelab/

Journal :

IEEE Publisher
https://www.ieee.org
Elsevier Publisher
https://www.elsevier.org
Science Direct Publisher
https://www.Sciencedirect.com

• **الضوابط والسياسات المتبعة في المقرر Course Policies**	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
1	**سياسة حضور الفعاليات التعليمية Class Attendance:** **- يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك.** **- يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.**
2	**الحضور المتأخر Tardy:** **- يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.**
3	**ضوابط الامتحان Exam Attendance/Punctuality:** **- لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان** **- إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.**
4	**التعيينات والمشاريع Assignments & Projects:** **- يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها.** **- إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.**
5	**الغش Cheating:** **- في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.** **- في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.**
6	**الانتحال Plagiarism:** **– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك**
7	**سياسات أخرى Other policies:** **- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ**