Sana'a University
Faculty of Engineering
Department: Electrical Engineering
Title of the Program: Electrical Power and Machines Engineering

30. Course Specification of Electrical Machines 1

I. Course Identification and General Information:							
1.	Course Title:	Electrical Machines 1					
2.	Course Code & Number:	PME221					
3.	Credit hours:	C.H				Total	
		Th.	Tu.	Pr.	Tr.		
		2	2	2		4	
4.	Study level/ semester at which this course is offered:	Third Year/ First Semester					
5.	Pre –requisite (if any):	Electrical Circuits 2 (PME112)					
6.	Co –requisite (if any):	None.					
7.	Program (s) in which the course is offered:	Electrical Power and Machines Engineering					
8.	Language of teaching the course:	English					
9.	Location of teaching the course:	Class &lab					
10.	Prepared By:	Assoc. Prof. Dr. Radwan Al bouthigy					
11.	Date of Approval						

II. Course Description:

This course is designed to provide principal concepts of electrical machines as a major Electric system component. The course includes: Electromechanical energy conversion (EMEC) principles, The construction, classification, performance characteristics, analysis, parallel operation, testing and applications of Single phase transformers, DC generators machines, and DC motors machines as well as, starting and speed control of the different types of motors. Laboratory experiments and MATLAB simulation tool are carried for different types of machines devices to verify the theoretical concepts.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1	Define the components, construction of DC machines, transformers., classification the types, characteristics of DC machines and transformers	A1

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a2	Describe the equivalent circuit, the mathematical model, and the operation conditions, starting methods and speed control of DC machines and transformers	A2
b1	Investigate the methods of controlling the generated voltage and speed of DC machines.	B1
b2	Evaluate the operation conditions, modeling and design principles of DC machines and transformer using mathematical models and computer simulation.	B3
c1	Analyze the effect of unbalanced loading on DC machine and transformer with different connections, and the effects and limitations of each connection, and measure the efficiency and the short circuit impedance of a single -phase transformers from no-load test, winding resistance, short circuit test, and load test.	C1
c2	Obtain experimentally the load characteristics of various DC motors and generators under different loading conditions.	C3
d1	Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.	D1, D4
d2	Develop transferable skills of problem solving and design.	D5

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Define the components and construction of DC machines and transformers .and classify the types, characteristics of DC machines and transformers	▪ Lectures, ▪ Tutorial, ▪ Interactive class discussions, ▪ Laboratory experiments, ▪ Self-study.	▪ Assignments, ▪ Written exams, ▪ quizzes
a2- Describe the equivalent circuit, the mathematical model, and the operation conditions, starting methods and speed control of DC machines and transformers	▪ Lectures, ▪ Tutorial, ▪ Interactive class discussions, ▪ Laboratory experiments, ▪ Self-study.	▪ Assignments, ▪ Written exams, ▪ Quizzes

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Investigate the methods of controlling the generated voltage and speed of DC machines.	▪ Lectures, ▪ Interactive class discussions, ▪ Laboratory experiments, ▪ Self and cooperative learning.	▪ Assignments, Quizzes, ▪ Written exams, Homework. ▪ Lab. reports.
b2- Evaluate the operation conditions, modeling and design principles of DC machines and transformer using mathematical models and computer simulation.	▪ Lectures, ▪ Interactive class discussions, ▪ Laboratory experiments, ▪ Self and cooperative learning.	▪ Assignments, Quizzes, ▪ Written exams, Homework. ▪ Lab. reports.

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© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Analyze the effect of unbalanced loading on DC machine and transformer with different connections, and the effects and limitations of each connection, and measure the efficiency and the short circuit impedance of a single -phase transformers from no-load test, winding resistance, short circuit test, and load test.	▪ Lectures, ▪ Interactive class discussion ▪ Exercises, ▪ Series of laboratory experiment, ▪ Self-study	▪ Quizzes ▪ Laboratory assignments and reports, ▪ Homework, ▪ Midterm and final exam.
c2- Obtain experimentally the load characteristics of various DC motors and generators under different loading conditions.	▪ Lectures, ▪ Interactive class discussion ▪ Exercises, ▪ Series of laboratory experiment, ▪ Self-study	▪ Quizzes ▪ Laboratory assignments and reports, ▪ Homework, ▪ Midterm and final exam.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.	▪ Interactive class discussion, ▪ Self-study	▪ Laboratory reports, ▪ Assignments, ▪ Quizzes, ▪ Written exams, ▪ Lab. Exams, ▪ Homework.
d2- Develop transferable skills of problem solving and design.		▪ Laboratory reports, ▪ Assignments,

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	▪ Interactive class discussion, ▪ Self-study	▪ Quizzes, ▪ Written exams, ▪ Lab. Exams, ▪ Homework.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Electrical Machines	a1,a2,b1,b2	▪ Magnetic circuits ▪ Definition of motor and generator. ▪ Torque development due to alignment of two fields and the concept of torque angle. ▪ Electro-magnetically induced emf. ▪ Elementary concept of an electrical machine.	2	4
2.	DC generators	a2, b1, b2, c1, c2, d1,	▪ Types, Construction, Operation principles and application areas. ▪ The performance characteristics and the equivalent circuit of DC generators. ▪ Modelica and/or MATLAB modeling of DC generator (self-study).	4	8
3.	DC motors	b1, b2, c1, c2, d1, d2	▪ Main distinction between DC generators and motors. ▪ Types, Construction, Operation principles and	4	8

			application areas of DC motors. ▪ Performance characteristics and the equivalent circuit of DC motors. ▪ Speed control of DC motors. ▪ The mathematical and MATLAB model of DC motor.		
4.	Single phase Transformers	a1, b2, c1, c2, d1, d2	▪ Ideal transformer ▪ Real transformer ▪ Construction ▪ Operation ▪ Equivalent circuit ▪ Modeling, Power and efficiency. ▪ Transformers Modelica and/or Simulink-MATLAB modeling- self-study assignment and resources.	4	8
Number of Weeks /and Units Per Semester				**14**	**28**

B- Tutorials Aspect:

Order	Tutorial Skills List	No of Weeks	C.H.	CILOs
1.	▪ Calculation of magnetic circuits, magnetic flux, flux density, magnetic field intensity, and permeability. ▪ Force and torque calculations.	2	4	a1, a2, b1, b2, d1, d2
2.	▪ Equivalent circuit of types DC generator. ▪ The performance characteristics. ▪ Graphical analysis. ▪ Modelica and/or MATLAB simulation of DC generator.	4	8	a1, a2, b1, b2, c1

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3.	▪ Equivalent circuit of types DC motor. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of DC motors.	4	8	a1, a2, b1, b2, c1
4.	▪ Determination of a single-phase Transformers' Parameters. ▪ Performance characteristics. ▪ Phasor diagram ▪ Voltage regulation ▪ Equivalent circuit ▪ Modelica and/or MATLB Transformer modeling.	4	8	a2,b1,b2,c1, d1,d2
Number of Weeks /and Units Per Semester		**14**	**28**	

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	▪ Safety regulations and requirements in electrical laboratories. ▪ Introduction to main laboratory devices and instrumentations. ▪ Introduction to main measurement devices. ▪ Reporting format.	1	2	a2,b1,b2,c1,c2
2.	▪ Open circuit characteristics of a separately excited D.C generator ▪ Terminal characteristics of a separately excited D.C generator	2	4	a1,a2,c1,c2
3.	▪ Terminal characteristics of a shunt, series and compound generators	3	6	,b1,b2,c1,c2,d1,d2

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4.	▪ Terminal characteristics of a separately, shunt, series and compound motors. ▪ Starting control of D.C motors	4	8	b1,b2,c1,c2d2
5.	▪ Open-circuit, Short-circuit and load test of single-phase transformer. ▪ Parameters of single-phase transformer.	3	6	b1,b2,c1,c2,d1,d2
7.	▪ Review.	1	2	a1,a2,b1,b2,
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures
- Interactive class discussion,
- Problem Solving
- Laboratory works
- Homework
- Self-study
- Self and cooperative learning
- Project work
- Simulation Tools

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of DC generator	a1, a2, b1, b2, d2	3rd	5
2.	Design and implementation of DC generator circuits using MATLAB tools	a1, a2, b1, b2, c1	4th	5
3.	Design and implementation of DC motor circuits using MATLAB tools	a1, a2, b1, b2, c1	6th	5
4.	Design and implementation of transformer circuits using MATLAB tools	a1, a2, b1, b2, c1	8th	5
	Total			**20**

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VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Quizzes	4^{th} ,7^{th} ,10^{th}, and 13^{th}	20	10%	a1,a2,b1,b2
2.	Assignments	Weekly	20	10%	a1,a2,b1,b2,d2
3.	Mid-Term exam	7^{th}	20	10%	a1,a2,b1,b2
4.	Final exam practical	15^{th}	40	20%	a1,a2,b1,b2,c1,c2,d2
5.	Final Exam theory	16^{th}	100	50%	a1,a2,b1,b2
	Total		**200**	**100%**	

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Chapman s. j. (2005), Electric Machinery Fundamentals,4th Edition, McGraw-Hill.
2. Fitzgerald A. E. (2003), Electric Machinery, 6h Edition, McGraw-Hill

2- Essential References.

1. D.F. Warne (2000), Newnes Electrical Engineer's Handbook, 1st Edition, Biddles Ltd- wwv. biddlesxo. Uk.
2. Nasar S. A. (1998), Electric machines and electromechanics, 2nd Edition, Schaum's outlines series- McGraw-Hill.
3. Bandyopadhyay M.N, (2009), ELECTRICAL MACHINES: THEORY AND PRACTICE, 1st Edition, Prentice-hall Of India Pvt Ltd.
4. Bimbhra P.S., (1995), Electric Machinery, 7th Edition Khanna Publishers.

3- Electronic Materials and Web Sites etc.

1. Modelica Association (2000). ModelicaTM - A Unified Object-Oriented Language for Physical Systems Modeling. Tutorial Version 1.4 (ModelicaTutorial14.pdf). Available from: https://modelica.org/documents/
2. MapleSim Video Tutorial: Modelica Video lectures available form: http://www.youtube.com/watch?v=reehU1dzeDc.
3. Simulink-Matlab tutorial for beginners Video lectures available form:

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	4. http://www.youtube.com/results?search_query=simulink+tutorial+for+beginners&oq=simulink&gs_l=youtube.1.9.0l10.337429.342148.0.351270.8.8.0.0.0.0.738.2481.3j3-2j2j0j1.8.0...0.0...1ac.1.11.youtube.iIK7kMX6hfo

IX. Course Policies:

1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat**

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	President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi **Name of Reviewer from the Department: Asst. Prof. Dr. Adel Ahmed Al-Shakiri**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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30. Template for Course Plan of Electrical Machines 1

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Assoc. Prof. Dr. Radwan Al bouthigy	**Office Hours**					
Location& Telephone No.	775284933	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	radwan00@yahoo.com						

II. Course Identification and General Information:

1.	Course Title:	Electrical Machines 1				
2.	Course Number & Code:	PME221				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/year at which this course is offered:	Third Year/ First Semester				
5.	Pre –requisite (if any):	Electrical circuits 2 (PME112)				
6.	Co –requisite (if any):	NA				
7.	Program (s) in which the course is offered	Electrical Power and Machines Engineering				
8.	Language of teaching the course:	English				
9.	System of Study:	Semester				
10.	Mode of delivery:	Semesters				
11.	Location of teaching the course:	Class & lab				

III. Course Description:

This course is designed to provide principal concepts of electrical machines as a major Electric system component. The course includes: Electromechanical energy conversion (EMEC) principles, The construction, classification, performance characteristics, analysis, parallel operation, testing and applications of Single phase transformers, DC generators machines, and DC motors machines as well as, starting and speed control of the different types of motors. Laboratory experiments and MATLAB simulation tool are carried for different types of machines devices to verify the theoretical concepts.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:

1. Define the components, construction of DC machines, transformers., classification the types, characteristics of DC machines and transformers
2. Describe the equivalent circuit, the mathematical model, and the operation conditions, starting methods and speed control of DC machines and transformers
3. Investigate the methods of controlling the generated voltage and speed of DC machines.
4. Evaluate the operation conditions, modeling and design principles of DC machines and transformer using mathematical models and computer simulation.
5. Analyze the effect of unbalanced loading on DC machine and transformer with different connections, and the effects and limitations of each connection, and measure the efficiency and the short circuit impedance of a single -phase transformers from no-load test, winding resistance, short circuit test, and load test.
6. Obtain experimentally the load characteristics of various DC motors and generators under different loading conditions.
7. Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.
8. Develop transferable skills of problem solving and design.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Electrical Machines	a1,a2,b1,b2	▪ Magnetic circuits ▪ Definition of motor and generator. ▪ Torque development due to alignment of two fields and the concept of torque angle. ▪ Electro-magnetically induced emf. ▪ Elementary concept of an electrical machine.	1st ,2nd	4
2.	DC generators	a2, b1, b2, c1, c2, d1,	▪ Types, Construction, Operation principles and application areas. ▪ The performance characteristics and the equivalent circuit of DC generators. ▪ Modelica and/or MATLAB modeling of DC generator (self-study).	3rd ,4th ,5th ,6th	8
3.	Mid-Term Exam	a1, a2, b1, b2,		7th	2
4.	DC motors	b1, b2, c1, c2, d1, d2	▪ Main distinction between DC generators and motors. ▪ Types, Construction, Operation principles and application areas of DC motors. ▪ Performance characteristics and the equivalent circuit of DC motors. ▪ Speed control of DC motors.	8th , 9th ,10th ,11th	8

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			▪ The mathematical and MATLAB model of DC motor.		
5.	Single phase Transformers	a1, b2, c1, c2, d1, d2	▪ Ideal transformer ▪ Real transformer ▪ Construction ▪ Operation ▪ Equivalent circuit ▪ Modeling, Power and efficiency. ▪ Transformers Modelica and/or Simulink-MATLAB modeling- self-study assignment and resources.	12th ,13th ,14th ,15th	8
6.	Final Exam	a1, a2, b1, b2,	▪ All topics.	16th	2
Number of Weeks /and Units Per Semester				**16**	**32**

B. Tutorials Aspect:

Order	Tutorial Skills List	No of Weeks	C.H.	CILOs
1.	▪ Calculation of magnetic circuits, magnetic flux, flux density, magnetic field intensity, and permeability. ▪ Force and torque calculations.	1st ,2nd	4	a1, a2, b1, b2, d1, d2
2.	▪ Equivalent circuit of types DC generator. ▪ The performance characteristics. ▪ Graphical analysis. ▪ Modelica and/or MATLAB simulation of DC generator.	3rd ,4th ,5th ,6th	8	a1, a2, b1, b2, c1
3.	▪ Equivalent circuit of types DC motor. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of DC motors.	7th ,8th ,9th ,10th	8	a1, a2, b1, b2, c1

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4.	▪ Determination of a single-phase Transformers' Parameters. ▪ Performance characteristics. ▪ Phasor diagram ▪ Voltage regulation ▪ Equivalent circuit ▪ Modelica and/or MATLB Transformer modeling.	11th ,12th ,13th ,14th	8	a2,b1,b2,c1, d1,d2
Number of Weeks /and Units Per Semester		**14**	**28**	

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	▪ Safety regulations and requirements in electrical laboratories. ▪ Introduction to main laboratory devices and instrumentations. ▪ Introduction to main measurement devices. ▪ Reporting format.	1st	2	a2,b1,b2,c1,c2
2.	▪ Open circuit characteristics of a separately excited D.C generator ▪ Terminal characteristics of a separately excited D.C generator	2nd ,3rd	4	a1,a2,c1,c2
3.	▪ Terminal characteristics of a shunt, series and compound generators	4th ,5th ,6th	6	,b1,b2,c1,c2,d1,d2
4.	▪ Terminal characteristics of a separately, shunt, series and compound motors. ▪ Starting control of D.C motors	7th ,8th ,9th ,10th	8	b1,b2,c1,c2d2
5.	▪ Open-circuit, Short-circuit and load test of single-phase transformer. ▪ Parameters of single-phase transformer.	11th ,12th ,13th	6	b1,b2,c1,c2,d1,d2

6.	▪ Review	14th	2	
7.	▪ Laboratory exam.	15th	2	a1,a2,b1,b2,
Number of Weeks /and Units Per Semester		**15**	**30**	

VI. Teaching strategies of the course:

- Lectures
- Interactive class discussion,
- Problem Solving
- Laboratory works
- Homework
- Self-study
- Self and cooperative learning
- Project work
- Simulation Tools

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of DC generator	a1,a2,b1,b2,d2	3rd	5
2.	Design and implementation of DC generator circuits using MATLAB tools	a1,a2,b1,b2,c1	4th	5
3.	Design and implementation of DC motor circuits using MATLAB tools	a1,a2,b1,b2,c1	6th	5
4.	Design and implementation of transformer circuits using MATLAB tools	a1,a2,b1,b2,c1	8th	5
	Total			**20**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes

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Academic Development Center & Quality Assurance
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Rector of Sana'a University
Prof. Dr. Al-Qassim Mohammed Abbas

1.	Quizzes	4^{th} ,7^{th} ,10^{th}, and 13^{th}	20	10%	a1,a2,b1,b2
2.	Assignments	Weekly	20	10%	a1,a2,b1,b2,d2
3.	Mid-Term exam	7^{th}	20	10%	a1,a2,b1,b2
4.	Final exam practical	15^{th}	40	20%	a1,a2,b1,b2,c1,c2,d2
5.	Final Exam theory	16^{th}	100	50%	a1,a2,b1,b2
	Total		**200**	**100%**	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Chapman s. j. (2005), Electric Machinery Fundamentals,4th Edition, McGraw-Hill.
2. Fitzgerald A. E. (2003), Electric Machinery, 6h Edition, McGraw-Hill

2- Essential References.

1. D.F. Warne (2000), Newnes Electrical Engineer's Handbook, 1st Edition, Biddles Ltd- wwv. biddlesxo. Uk.
2. Nasar S. A. (1998), Electric machines and electromechanics, 2nd Edition, Schaum's outlines series- McGraw-Hill.
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3- Electronic Materials and Web Sites etc.

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2. MapleSim Video Tutorial: Modelica Video lectures available form: http://www.youtube.com/watch?v=reehU1dzeDc.
3. Simulink-Matlab tutorial for beginners Video lectures available form:
4. http://www.youtube.com/results?search_query=simulink+tutorial+for+beginners&oq=simulink&gs_l=youtube.1.9.0l10.337429.342148.0.351270.8.8.0.0.0.0.738.2481.3j3-2j2j0j1.8.0...0.0...1ac.1.11.youtube.iIK7kMX6hfo

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X. Course Policies:	
1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy**: For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

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