Course Specification of: Modeling and Simulation of Engineering Systems

Course Code: (MTE543)

•General Information About the Course:						
85.	**Course Title:**	**Modeling and Simulation of Engineering Systems**				
86.	**Course Code and Number:**	**MTE543**				
87.	**Credit Hours:**	**Credit Hours**			**Total**	
		Lecture	Practical	Seminar/Tutorial		
		3	0	0	3	
88.	**Study Level and Semester:**	**Second Semester**				
89.	**Pre-requisites (if any):**	- Numerical Analysis - Mathematics (Differential Equations)				
90.	**Co-requisites (if any):**	**None**				
91.	**Program (s) in which the course is offered:**	MSc. In Mechatronics Engineering Program				
92.	**Language of teaching the course:**	English				
93.	**Study System:**	Courses & Thesis				
94.	**Prepared By:**	Dr. Hatem Al-Dois				
95.	**Reviewed by:**	Dr. ……				
96.	**Date of Approval:**					

•Course Description:

Modeling and Simulation methods are widely employed in various branches of Engineering. In fact, many engineering systems and operating processes can be approximated by mathematical models, allowing to predict their future trends or infer their current state. This course is intended to present several approaches towards model identification problems, in order to help students solve experimental modeling problems in mechatronics and other related areas. Students will learn the theoretical and practical knowledge of methods to develop mathematical models for systems from different domains either from physical insight or experimental data. Parametric and non-parametric identification methods, transient response analysis. frequency response analysis. spectrum analysis, correlation analysis and Identification Methods Based on Probabilistic Approaches are introduced. In addition, modeling solutions to various engineering applications are practiced and examined.

•Course Intended Learning Outcomes (CILOs):

a1. Explain various mathematical methods for building models of mechatronics systems based on physical principles and measured data.

a2. List different types of engineering systems models and modeling techniques.

a3. Describe the parametric and non-parametric identification techniques to obtain mathematical models for mechatronics systems.

a4. Explain how numerical methods are used for modern system identification.

b1. Compare and contrast different valid models for the system, and justify the final model choice.

b2. Construct mathematical models of mechatronics systems and components from first principles and measured data manually as well as with the help of computer tools.

b3. Analyze statistical properties of basic modeling and estimation techniques, and clarify the practical significance of these properties.

c1. Perform various validation tests of mathematically constructed mechatronics models.

c2. Propose and implement solutions to simple identification problems.

c3. Use computer simulation tools to model and examine mechatronic system designs.

c4. Apply the complete procedure to identify a simulated unknown industrial SISO process with noise.

d1. Outline the structure of a formal technical report with proper referencing.

d2. Plan and carry out activities in a way which makes optimal use of available time and other resources.

d3. Deliver high-quality presentations and demonstrate presentation skills.

d4. Develop an independent learning capability that leads to a thorough knowledge and practice in the field.

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

CILOs		PILOs
gg. Knowledge and Understanding: Upon successful completion of **the Modeling and Simulation of Engineering Systems Course**, the graduates will be able to:		**GG. Knowledge and Understanding:** Upon successful completion of the **MSc. In Mechatronics Engineering Program**, the graduates will be able to:
a1.	Explain various mathematical methods for building models of mechatronics systems based on physical principles and measured data.	**A1.** Demonstrate in-depth understanding of applied mathematics in Mechatronics engineering, control system, computer engineering and science,

		and electronics to design more functional, adaptable and cost-effective products.
a2.	List different types of engineering systems models and modeling techniques.	**A2.** Recognize and explain the contemporary engineering technologies and issues in the field of Mechatronics engineering.
a3.	Describe the parametric and non-parametric identification techniques to obtain mathematical models for mechatronics systems.	**A3.** Explain in-depth the principles of sustainable design and development of Mechatronics engineering.
a4.	Explain how numerical methods are used for modern system identification.	**A4.** Demonstrate research principles and methods applicable to the field of work or academic in Mechatronics engineering and related fields.
hh. Cognitive/ Intellectual Skills: Upon successful completion of the **Modeling and Simulation of Engineering Systems Course,** the graduates will be able to:		**HH. Cognitive/ Intellectual Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:
b1.	Compare and contrast different valid models for the system, and justify the final model choice.	**B1.** Apply appropriate principles, methodologies, techniques, tools and packages in the analysis, development and evaluation of mechatronics engineering systems.
b2.	Construct mathematical models of mechatronics systems and components from first principles and measured data manually as well as with the help of computer tools.	**B2.** Identify, formulate and analyze research and solve complex Mechatronics engineering problems.
b3.	Analyze statistical properties of basic modeling and estimation techniques, and clarify the practical significance of these properties.	**B3.** Design Mechatronics system, component, or process to meet desired needs within realistic constraints.
ii. Professional and Practical Skills: Upon successful completion of the **Modeling and Simulation of Engineering Systems Course,** the graduates will be able to:		**II. Professional and Practical Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:

c1.	Perform various validation tests of mathematically constructed mechatronics models.	**C1.** Conduct research to solve mechatronics engineering problems.
c2.	Propose and implement solutions to simple identification problems.	**C2.** Use advanced methodologies and skills to solve Mechatronics engineering problems.
c3.	Use computer simulation tools to model and examine mechatronic system designs.	**C2.** Use advanced methodologies and skills to solve Mechatronics engineering problems.
c4.	Apply the complete procedure to identify a simulated unknown industrial SISO process with noise.	**C3.** Apply acquired knowledge of analysis and design for mechatronics engineering systems and implementation process.
jj.	**Transferable Skills:** Upon successful completion of the **Modeling and Simulation of Engineering Systems Course,** the graduates will be able to:	**JJ. Transferable Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:
d1.	Outline the structure of a formal technical report with proper referencing.	**D1.** Prepare a complete thesis and term-courses works/ tasks, write their documents and defend on them.
d2.	Plan and carry out activities in a way which makes optimal use of available time and other resources.	**D2.** Demonstrate ethical principles, awareness of professional and ethical responsibility as well as knowledge of the standards utilized in related fields.
d3.	Deliver high-quality presentations and demonstrate presentation skills.	**D3.** Conduct independently and communicate research that advances and extends knowledge and scholarship in related fields.
d4.	Develop an independent learning capability that leads to a thorough knowledge and practice in the field.	**D4.** Independent learning ability, self-direction and independence leading to the ability to continue to develop their knowledge understanding and skills through further professional development

•Alignment of CILOs to Teaching and Assessment Strategies

gg. Alignment of Knowledge and Understanding CILOs:

Knowledge and Understanding CILOs		Teaching Strategies	Assessment Strategies
a1.	Explain various mathematical methods for building models of mechatronics systems based on physical principles and measured data.	▪ Lectures, ▪ Active learning.	▪ Written Exam, ▪ Reports, ▪ Assignments
a2.	List different types of engineering systems models and modeling techniques.	▪ Lectures, ▪ Self-Learning Problems/Studies, ▪ Case study, ▪ Active learning.	▪ Oral & Writing Exams ▪ Reports, ▪ Survey.
a3.	Describe the parametric and non-parametric identification techniques to obtain mathematical models for mechatronics systems.	▪ Lectures, ▪ Self-Learning Problems/Studies, ▪ Case study, ▪ Active learning.	▪ Reports, ▪ Written Exam, ▪ Assignments
a4.	Explain how numerical methods are used for modern system identification.	▪ Lectures, ▪ Self-Learning Problems/Studies.	▪ Reports, ▪ Written Exam.

hh. Alignment of Intellectual Skills CILOs:

Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1.	Compare and contrast different valid models for the system, and justify the final model choice.	▪ Lectures, ▪ Self-Learning, ▪ Simulation Exercises, ▪ Analysis and Problem Solving, ▪ Brainstorming.	▪ Written Exam, ▪ Assignments.
b2.	Construct mathematical models of mechatronics systems and components from first principles and measured data manually as well as with the help of computer tools.	▪ Lectures, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study.	▪ Reports, ▪ Written Exam, ▪ Assignments
b3.	Analyze statistical properties of basic modeling and estimation techniques, and clarify the practical significance of these	▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem	▪ Reports, ▪ Survey, ▪ Written Exam, ▪ Assignments

•Alignment of CILOs to Teaching and Assessment Strategies

	properties.	Solving, ▪ Brainstorming.	

ii. Alignment of Professional and Practical Skills CILOs:

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	Perform various validation tests of mathematically constructed mechatronics models.	▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving.	▪ Written Research Proposal.
c2.	Propose and implement solutions to simple identification problems.	▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving.	▪ Seminar Report, ▪ Written Research Proposal.
c3.	Use computer simulation tools to model and examine mechatronic system designs.	▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving.	▪ Seminar Report.
c4.	Apply the complete procedure to identify a simulated unknown industrial SISO process with noise.	▪ Case Study, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Presentations,	▪ Seminar Report, ▪ Written Research Proposal.

jj. Alignment of Transferable (General) Skills CILOs:

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	Outline the structure of a formal technical report with proper referencing.	▪ Presentation, ▪ Presenting Researches, ▪ Publish Research Papers.	▪ Survey, ▪ Presentation, ▪ Written Report.
d2.	Plan and carry out activities in a way which makes optimal use of available time and other resources.	▪ Presentation, ▪ Presenting Researches.	▪ Assignments, ▪ Written Report.
d3.	Deliver high-quality presentations and demonstrate presentation skills.	▪ Presentation, ▪ Presenting Researches.	▪ Presentation, ▪ Written Report.
d4.	Develop an independent learning capability that leads to a thorough knowledge and practice in the field.	▪ Independent Study, ▪ Brainstorming.	▪ Assignments, ▪ Presentation, ▪ Written Report.

•Course Content

26. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
1	**Introduction**	- Fundamental Concepts - Use and scope of mathematical modeling, - Principles of model formulation, - Classification of models, - Model building, - Modeling difficulties,	1	3	a1, a2
2	**Mathematical Modeling of Systems from Different Domains**	- Principles of mathematical modeling - Block diagram models - Differential equations - The transfer function - Modeling of electrical networks - Modeling of linear & rotational mechanical systems - Modeling of fluid and thermal systems - TF for electromechanical system - Electric circuit analogy	1	3	a1, a2, a4
3	**Model Identification: Principles and Applications**	- Identification problems in linear and non-linear systems. - Overview of parametric and non-parametric methods. - Mathematical models for dynamic or stochastic systems. - Plausible application fields and practical examples.	1	3	a1, a3, b1
4	**Identification Methods Based on Spectral Analysis**	- Static spectral analysis in Fourier transform domain. - Resolution enhancement approaches (STFT, IpDFT). - Non-periodicity and truncation effects in discrete time. - Dynamic extension through Taylor series expansion. - Measurement uncertainty and Cramer-Rao bounds.	1	3	a3, b1, b2, b3, c1
5	**Identification Methods Based on**	- Properties of Auto- and Cross-correlation functions.	1	3	a3, b1, b2, b3,

•Course Content

26. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
	Correlation Analysis	- Influence of stochastic disturbances on correlation. - Definition of system impulse response by deconvolution. - Auto-regressive integrated moving average (ARIMA) predictors. - Proper setting to avoid excessive smoothing and stationarization. - Influence of noise model on prediction accuracy.			c1
6	**Identification Methods Based on Parametric Models**	- Fundamentals of Weighted Least Squares (WLS) estimator. - Estimates covariance and model uncertainty. - Parameter identifiability: criteria and conditions. - Tikhonov regularization to avoid ill-posed problems. - Two-stages LS approximation in non-parametric conditions. - WLS-based approximation of system frequency response.	2	6	a3, b1, b2, b3, c1, c2
7	**Mid-Term Exam**	- Previous Topics	1	3	a1, b1, b2, b3, c1, c2
8	**Identification Methods Based on Probabilistic Approaches**	- Bayes and Maximum-Likelihood estimation (MLE). - Cramer-Rao bounds and estimation reliability. - Gauss-Markov model: linearity and uncorrelation. - Particle filters: non-linear process models. - Particle filters: non-normal covariance noises.	1	3	a3, b1, b2, b3, c2, c4
9	**Identification Methods for**	- Polynomial approximation. - Differentiability constraint. - Kernel-based identification.	1	3	a3, b1, b2, b3,

•Course Content

26. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
	Dynamic Non-Linear Systems	- Hammerstain-Wiener models.			c1, c2, c4
10	**Application: State Estimation in Electrical Power Grids**	- Power system modeling as stochastic process. - State estimation measurement and process. - WLS-based static state estimation. - KF-based recursive state estimation. - Particle filter-based state estimation.	1	3	b2, b3, c1, c2, c3, d4
11	**Approximation of Unknown Power Spectral Density – Practical Application**	- Modeling of dynamic stochastic process - Computation examples - Estimation uncertainty	1	3	b2, b3, c1, c2, c3
12	**Linear WLS Approach for Grid State Estimation – Practical Application**	- State estimation problem formulation - Suitable tuning of weights matrix - Measurement uncertainty effect	1	3	b2, b3, c1, c2, c3
13	**Kalman filter Model to Track a Dynamic Process – Practical Application**	- First-order state model - Second-order state model - Suitable probability thresholds	1	3	b2, b3, c1, c2, c3
14	**Particle Filter Estimation of The System Internal State**	- Two-steps recursive procedure - Suitable selection of process model (grid) - Suitable selection of noise model (measurements)	1	3	b2, b3, c1, c2, c3
15	**Final Exam**	- All Topics	1	3	a1, b1, b2, b3, c1, c2

•Course Content

26. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
Number of Weeks /and Contact Hours Per Semester			16	48	

27. Practical Aspect

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

28. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Course ILOs
1	None	--	--	--
Number of Weeks /and Units Per Semester		--	--	

•Teaching Strategies:

- Lectures,
- Self-Learning Problems/Studies,
- Case study,
- Active learning,
- Simulation Exercises,
- Analysis and Problem Solving,
- Brainstorming,
- Independent Study,
- Publish Research Papers,
- Presenting Researches,
- Presentation.

•Assessment Methods of the Course:

- Written Exam,
- Reports,
- Survey,
- Oral & Writing Exams

•Assessment Methods of the Course:

- Assignments,
- Written Research Proposal,
- Seminar Report
- Survey,
- Presentation,
- Written Report.

•Tasks and Assignments:

No.	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1	**Identification Mini-project** Projects can be done individually but preferably in group of 2 to 3 students. Students will be asked to build a complete mathematical model of a mechatronics system of their choice (subjected to the approval of the course instructor). The model must be simulated and the results should be analyzed and verified. ***Results Delivery:*** - The result of the course project will be a scientific paper (minimum 5 pages) along with part of the source code developed to solve a given problem (if any). - IEEE Manuscript Template must be used.	**Group 2-3 students or Individual**	**20**	**14**	b2, b3, c1, c2, c3, c4, d1, d2, d3, d4
Total Score			**20**		

•Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1	**Tasks and Assignments**	**14**	**20**	**20%**	b2, b3, c1, c2, c3, c4, d1, d2,
2	**Midterm Exam (Theoretical)**	**8**	**20**	**20%**	a1, b1, b2, b3, c1, c2
3	**Final Exam (Theoretical)**	**16**	**60**	**60%**	a1, b1, b2, b3, c1, c2
Total			**100**	**100%**	

•Learning Resources :

24.Required Textbook(s) :

6- P. P. J. van den Bosch & AC van der Klauw, 2020, Modeling, Identification and Simulation of Dynamical Systems 1st Edition, CRC Press, FL-USA.

7- Rolf Johansson, 1993, System Modeling and Identification, 1st Edition, Prentice-Hall International, NJ-USA.

25.Essential References:

1- L. Ljung and T. Glad, 1994, Modeling of Dynamic Systems, 1st Edition, Prentice Hall, NJ-USA.

2- L. Ljung, 1999, System Identification: Theory for the User, 2nd Edition, Prentice Hall, NJ-USA.

3- Dean C. Karnopp, Donald L. Margolis, Ronald C. Rosenberg, 2003, System Dynamics: Modeling, Simulation, and Control of Mechatronic Systems, 5th Edition, Wiley, N.Y., USA.

4- A. Lindquist & G. Picci, 2015, Linear Stochastic Systems: A Geometric Approach to Modeling, Estimation and Identification, 1st Edition, Springer, NY-USA.

5- Roland Toth, 2010, Modeling and Identification of Linear Parameter-Varying Systems, 1st Edition, Springer, NY-USA.

6- Devendra K. Chaturvedi, 2002, Modeling and Simulation of Systems Using MATLAB and Simulink, , CRC Press, FL-USA.

26.Electronic Materials and Web Sites *etc.*

Websites:

1- KTH | EL1820 Modelling of Dynamical Systems Course at KTH, (Sweden) https://www.kth.se/student/kurser/kurs/EL2820?l=en

2- Kurssida: System Identification Course at Chalmers University of Technology (Sweden) https://www.chalmers.se/sv/institutioner/e2/Sidor/default.aspx

3- Systems Control Demonstrations at Johns Hopkins University http://www.jhu.edu/~signals/

Journals:

1- International Journal of Modelling and Simulation, Taylor & Frances https://www.tandfonline.com/toc/tjms20/current

2- International Journal of Engineering Systems Modelling and Simulation, Inderscience Enterprises https://www.inderscience.com/jhome.php?jcode=ijesms

3- Discrete Event Dynamic Systems Theory and Applications, , Springer https://link.springer.com/journal/10626

4- International Journal of Simulation Modeling, DAAAM International http://www.ijsimm.com/

5- The World Journal of Modeling and Simulation, World Academia Press http://www.wjms.org.uk/

•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**

Academic Year: 2021-2022

Course Plan (Syllabus): Modeling and Simulation of Engineering Systems

• Information about Faculty Member Responsible for the Course:

Name	Dr. Hatem Al-Dois	Office Hours					
Location &Telephone No.	774677493	SAT	SUN	MON	TUE	WED	THU
E-mail	haldois@yah.com						

• General information about the course:

10.	Course Title	Modeling and Simulation of Engineering Systems			
11.	Course Code and Number	MTE543			
12.	Credit Hours	Credit Hours			Total
		Lecture	Practical	Seminar/Tutorial	
		3	0	0	3
13.	Study Level and Semester	First Semester			
14.	Pre-requisites	- Numerical Analysis - Mathematics (Differential Equations)			
15.	Co –requisite	None			
16.	Program (s) in which the course is offered	MSc. In Mechatronics Engineering Program			
17.	Language of teaching the course	English			
18.	Location of teaching the course	Faculty of Engineering, Sana'a University			

•Course Description:

Modeling and Simulation methods are widely employed in various branches of Engineering. In fact, many engineering systems and operating processes can be approximated by mathematical models, allowing to predict their future trends or infer their current state. This course is intended to present several approaches towards model identification problems, in order to help students solve experimental modeling problems in mechatronics and other related areas. Students will learn the theoretical and practical knowledge of methods to develop mathematical models for systems from

•Course Description:

different domains either from physical insight or experimental data. Parametric and non-parametric identification methods, transient response analysis. frequency response analysis. spectrum analysis, correlation analysis and Identification Methods Based on Probabilistic Approaches are introduced. In addition, modeling solutions to various engineering applications are practiced and examined.

•Course Intended Learning Outcomes (CILOs):

a1. Explain various mathematical methods for building models of mechatronics systems based on physical principles and measured data.

a2. List different types of engineering systems models and modeling techniques.

a3. Describe the parametric and non-parametric identification techniques to obtain mathematical models for mechatronics systems.

a4. Explain how numerical methods are used for modern system identification.

b1. Compare and contrast different valid models for the system, and justify the final model choice.

b2. Construct mathematical models of mechatronics systems and components from first principles and measured data manually as well as with the help of computer tools.

b3. Analyze statistical properties of basic modeling and estimation techniques, and clarify the practical significance of these properties.

c1. Perform various validation tests of mathematically constructed mechatronics models.

c2. Propose and implement solutions to simple identification problems.

c3. Use computer simulation tools to model and examine mechatronic system designs.

c4. Apply the complete procedure to identify a simulated unknown industrial SISO process with noise.

d1. Outline the structure of a formal technical report with proper referencing.

d2. Plan and carry out activities in a way which makes optimal use of available time and other resources.

d3. Deliver high-quality presentations and demonstrate presentation skills.

d4. Develop an independent learning capability that leads to a thorough knowledge and practice in the field.

•Course Content

- **Theoretical Aspect**

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
1	**Introduction**	- Fundamental Concepts - Use and scope of mathematical modeling, - Principles of model formulation,	1	3

•Course Content

- **Theoretical Aspect**

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
		- Classification of models, - Model building, - Modeling difficulties,		
2	**Mathematical Modeling of Systems from Different Domains**	- Principles of mathematical modeling - Block diagram models - Differential equations - The transfer function - Modeling of electrical networks - Modeling of linear & rotational mechanical systems - Modeling of fluid and thermal systems - TF for electromechanical system - Electric circuit analogy	1	3
3	**Model Identification: Principles and Applications**	- Identification problems in linear and non-linear systems. - Overview of parametric and non-parametric methods. - Mathematical models for dynamic or stochastic systems. - Plausible application fields and practical examples.	1	3
4	**Identification Methods Based on Spectral Analysis**	- Static spectral analysis in Fourier transform domain. - Resolution enhancement approaches (STFT, IpDFT). - Non-periodicity and truncation effects in discrete time. - Dynamic extension through Taylor series expansion. - Measurement uncertainty and Cramer-Rao bounds.	1	3
5	**Identification Methods Based on Correlation Analysis**	- Properties of Auto- and Cross-correlation functions. - Influence of stochastic disturbances on correlation. - Definition of system impulse response by deconvolution. - Auto-regressive integrated moving average (ARIMA) predictors.	1	3

•Course Content

- **Theoretical Aspect**

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
		- Proper setting to avoid excessive smoothing and stationarization. - Influence of noise model on prediction accuracy.		
6	**Identification Methods Based on Parametric Models**	- Fundamentals of Weighted Least Squares (WLS) estimator. - Estimates covariance and model uncertainty. - Parameter identifiability: criteria and conditions. - Tikhonov regularization to avoid ill-posed problems. - Two-stages LS approximation in non-parametric conditions. - WLS-based approximation of system frequency response.	2	6
7	**Mid-Term Exam**	- Previous Topics	1	3
8	**Identification Methods Based on Probabilistic Approaches**	- Bayes and Maximum-Likelihood estimation (MLE). - Cramer-Rao bounds and estimation reliability. - Gauss-Markov model: linearity and uncorrelation. - Particle filters: non-linear process models. - Particle filters: non-normal covariance noises.	1	3
9	**Identification Methods for Dynamic Non-Linear Systems**	- Polynomial approximation. - Differentiability constraint. - Kernel-based identification. - Hammerstain-Wiener models.	1	3
10	**Application: State Estimation in Electrical Power Grids**	- Power system modeling as stochastic process. - State estimation measurement and process. - WLS-based static state estimation. - KF-based recursive state estimation. - Particle filter-based state estimation.	1	3
11	**Approximation of Unknown Power**	- Modeling of dynamic stochastic process - Computation examples	1	3

•Course Content

- **Theoretical Aspect**

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
	Spectral Density – Practical Application	- Estimation uncertainty		
12	**Linear WLS Approach for Grid State Estimation – Practical Application**	- State estimation problem formulation - Suitable tuning of weights matrix - Measurement uncertainty effect	1	3
13	**Kalman filter Model to Track a Dynamic Process – Practical Application**	- First-order state model - Second-order state model - Suitable probability thresholds	1	3
14	**Particle Filter Estimation of The System Internal State**	- Two-steps recursive procedure - Suitable selection of process model (grid) - Suitable selection of noise model (measurements)	1	3
15	**Final Exam**	- All Topics	1	3
Number of Weeks /and Contact Hours Per Semester			**16**	**48**

- **Practical Aspect**

Order	Practical / Tutorials topics	Number of Weeks	Contact Hours
1	None	--	--
Number of Weeks /and Contact Hours Per Semester		--	--

- **Tutorial Aspect:**

No.	Tutorial	Number of Weeks	Contact Hours
1	None	--	--
Number of Weeks /and Units Per Semester		--	--

•Teaching Strategies:

- Lectures,
- Self-Learning Problems/Studies,
- Case study,
- Active learning,
- Simulation Exercises,
- Analysis and Problem Solving,
- Brainstorming,
- Independent Study,
- Publish Research Papers,
- Presenting Researches,
- Presentation.

•Assessment Methods of the Course:

- Written Exam,
- Reports,
- Survey,
- Oral & Writing Exams
- Assignments,
- Written Research Proposal,
- Seminar Report
- Survey,
- Presentation,
- Written Report.

•Tasks and Assignments:

No.	Assignments/ Tasks	Individual/ Group	Mark	Week Due
1	**Identification Mini-project** Projects can be done individually but preferably in group of 2 to 3 students. Students will be asked to build a complete mathematical model of a mechatronics system of their choice (subjected to the approval of the course instructor). The model must be simulated and the results should be analyzed and verified. ***Results Delivery:***	**Group 2-3 students or Individual**	**20**	**14**

•Tasks and Assignments:

No.	Assignments/ Tasks	Individual/ Group	Mark	Week Due
	- The result of the course project will be a scientific paper (minimum 5 pages) along with part of the source code developed to solve a given problem (if any). - IEEE Manuscript Template must be used.			
Total Score			**20**	

•Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment
1	**Tasks and Assignments**	**14**	**20**	**20%**
2	**Midterm Exam (Theoretical)**	**8**	**20**	**20%**
3	**Final Exam (Theoretical)**	**16**	**60**	**60%**
Total			**100**	**100%**

•Learning Resources :

4. Required Textbook(s) :

1- P. P. J. van den Bosch & AC van der Klauw, 2020, Modeling, Identification and Simulation of Dynamical Systems 1st Edition, CRC Press, FL-USA.

2- Rolf Johansson, 1993, System Modeling and Identification, 1st Edition, Prentice-Hall International, NJ-USA.

5. Essential References:

1- L. Ljung and T. Glad, 1994, Modeling of Dynamic Systems, 1st Edition, Prentice Hall, NJ-USA.

2- L. Ljung, 1999, System Identification: Theory for the User, 2nd Edition, Prentice Hall, NJ-USA.

3- Dean C. Karnopp, Donald L. Margolis, Ronald C. Rosenberg, 2003, System Dynamics: Modeling, Simulation, and Control of Mechatronic Systems, 5th Edition, Wiley, N.Y., USA.

4- A. Lindquist & G. Picci, 2015, Linear Stochastic Systems: A Geometric Approach to Modeling, Estimation and Identification, 1st Edition, Springer, NY-USA.

5- Roland Toth, 2010, Modeling and Identification of Linear Parameter-Varying Systems, 1st Edition, Springer, NY-USA.

6- Devendra K. Chaturvedi, 2002, Modeling and Simulation of Systems Using MATLAB and Simulink, , CRC Press, FL-USA.

•Learning Resources :

6. Electronic Materials and Web Sites *etc.*

Websites:

1- KTH | EL1820 Modelling of Dynamical Systems Course at KTH, (Sweden)
https://www.kth.se/student/kurser/kurs/EL2820?l=en

2- Kurssida: System Identification Course at Chalmers University of Technology (Sweden)
https://www.chalmers.se/sv/institutioner/e2/Sidor/default.aspx

3- Systems Control Demonstrations at Johns Hopkins University
http://www.jhu.edu/~signals/

Journals:

1- International Journal of Modelling and Simulation, Taylor & Frances
https://www.tandfonline.com/toc/tjms20/current

2- International Journal of Engineering Systems Modelling and Simulation, Inderscience Enterprises
https://www.inderscience.com/jhome.php?jcode=ijesms

3- Discrete Event Dynamic Systems Theory and Applications, , Springer
https://link.springer.com/journal/10626

4- International Journal of Simulation Modeling, DAAAM International
http://www.ijsimm.com/

5- The World Journal of Modeling and Simulation, World Academia Press
http://www.wjms.org.uk/

•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:**

•الضوابط والسياسات المتبعة في المقرر Course Policies	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك	
سياسات أخرى Other policies:	7
- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ	

12-

Course Specification in Advance Project Management (FR502)

V. Course Identification and General Information					
1	Course Title:	**Advance Project Management**			
2	Course Code & Number:	FR502			
3	Credit hours:	Credit Hours (CH)			Credit Hours
		Lecture	Laboratory	Seminars	
		3	-	-	3
4	Study semester at which this course is offered:	Second Semester			
5	Pre –requisite (if any):	-			
6	Co –requisite (if any):	None			
7	Program (s) in which the course is offered:	M.Sc. in All Engineering program			
8	Language of teaching the course:	Arabic or/ and English			
9	Course type	Elective			
10	Location of teaching the course:	Faculty of Engineering, Master programs class rooms			
11	Prepared By:	Prof. Dr. Eng. Wael A. Alaghbari			
12	Date of Approval				

VI. Course Description:

This course introduces the student to basic methodologies and analytical methods for project design and implementation in various industries, in addition to providing the student with a clear understanding of how to organize and manage the necessary resources within the specified scope of work, time, cost, quality requirements, and within acceptable levels of risk. This course introduces the principles of project management and their applications in various project processes. The

knowledge that the student acquires from studying this course also enables the student to easily apply various management theories in their own projects to achieve results within the specified objectives.

VII. Course Intended Learning Outcomes (CILOs)		**Referenced PILOs**	**I, E, A**
a1	Demonstrate holistic understanding of the principal components and concepts of project management and applications of good management practices to enhance innovation and maintain competitiveness	A3	A
b1	Evaluate project processes, and using necessary tools and effectively address the challenges that will be faced during the project, in order to make better decisions, develop and implement plans and strategies.	B3	E
c1	Apply knowledge, skills and management techniques to solve problems, implement contemporary projects and operations effectively and efficiently.	C1	A
c2	Use core engineering management concepts flexibly in a variety of contexts to meet the important technical and management needs of private and public organizations.	C4	E
d1	Demonstrate awareness of professional and ethical responsibility during execute and manage the project processes	D1	A
d2	Gain new skills of self-development, developing effective communication and leadership skills	D4	I

(A) Alignment of Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
a.1	Demonstrate holistic understanding of the principal components and concepts of project management and applications of good management practices to enhance innovation and maintain competitiveness	Lectures, Demonstrations, Interactive class discussion	Multiple choice tests, Assignments, Presentations, Quizzes, Exams

(B) Alignment of Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
b.1	Evaluate project processes, and using necessary tools and effectively address the challenges that will be faced during the project, in order to make better decisions, develop and implement plans and strategies.	Lectures, Demonstrations, Interactive class discussions	Assignments, Oral Presentations, Quizzes, Exams

(C) Alignment of Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:			
Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
c.1	Apply knowledge, skills and management techniques to solve problems, implement contemporary projects and operations effectively and efficiently.	Lectures, Demonstrations, Interactive class discussions	Assignments, Oral Presentations, Quizzes, Exams
c.2	Use core engineering management concepts flexibly in a variety of contexts to meet the important technical and management needs of private and public organizations.		

(D) Alignment of Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:			
Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
d.1	Demonstrate awareness of professional and ethical responsibility during execute and manage the project processes	Lectures, Demonstrations, Interactive class discussions	Assignments, Oral Presentations, Quizzes
d.2	Gain new skills of self-development, developing effective communication and leadership skills		

VIII. Course Content

A – Lecture Aspects

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction: - What is a project and project management? - What is a role of Project manager, duties and responsibilities? - Purpose of Project Management	a.1, b.1, c.1, c.2, d.1, d.2	- Definition of the course plan - Definition of the course topics: ▪Benefits of project management ▪Projects and their environment ▪Projects, strategy, and project alignment ▪Projects, organizational structure, and governance ▪Project constraints: types, interdependency, and balance ▪Project life cycles ▪Process groups and processes ▪Project's requirements, scope, and specification	1	3

			▪Network of project activities and identifying the critical path ▪ Projects resources		
2.	Project phases and project life cycle.	a.1, b.1, c.1, c.2, d.1, d.2	- The 5 phases: initiating, planning, executing, monitoring/controlling, and closing 1. Project Initiation Phase · 2. Project Planning Phase · 3. Project Execution Phase · 4. Project Monitoring/ Controlling Phase 5. Project Close out or closing - The project management life cycle should define the following aspects: 1. What work needs to be achieved? 2. Who will be involved in the team? 3. What are the project deliverables? 4. How to monitor the performance of each phase? https://www.invensislearning.com/blog/5-phases-project-management-lifecycle/	1	3
3.	Project Planning	a.1, b.1, c.1, c.2, d.1, d.2	▪ Scope management plan ▪ Requirements management plan ▪ Project cost plan ▪ Project scheduling ▪ Resource and stakeholder's management plan ▪ Quality and risk management plan ▪ Estimation techniques	1	3
4	Project Time management	a.1, b.1, c.1, c.2, d.1, d.2	▪ Creating networks, estimating durations, and analyzing the critical path ▪ Estimating, analyzing, and managing the schedule, using the critical path method (CPM), critical chain, and PERT ▪ Optimizing the schedule and assessing the impact on resources and costs-crashing and fast-tracking ▪ Managing schedule variance using earned-value analyses, and optimizing schedule performance using corrective options and actions ▪ Estimating schedule contingencies, schedule buffers, and management reserves, and managing risk ▪ Understanding schedule-management approaches and tactics to keep projects on schedule	2	6

			▪ Schedule and cost integration		
5	Project Cost Management: (Bill of Quantities).	a.1, b.1, c.1, c.2, d.1, d.2	▪ Project cost estimating ▪ Project cost budgeting and control ▪ Estimating approaches and models ▪ Improving the estimation process ▪ Financial management ▪ Value management ▪ Time and cost change management ▪ Impact of cost-estimation changes on project	1	3
6	- Clients and Contracts. - Managing design development.	a.1, b.1, c.1, c.2, d.1, d.2	▪ Introduction to Law and the Legal system ▪ Legal issues as they pertain to project procurement ▪ Contracts and procurement ▪ Contract Negotiation ▪ Health, safety, and legal implications ▪ Employment laws ▪ Complying with standards and regulations, both local and global ▪ Ending Contracts ▪ Breaking contracts: consequences ▪ Data protection, data privacy	1	3
7	Managing procurement process (design/ supervision services).	a.1, b.1, c.1, c.2, d.1, d.2	▪ Foundational knowledge of procurement ▪ Understanding the role of supply chains in project management ▪ Project supply-chain building blocks ▪ The project-planning chain and project-delivery chain ▪ Vendors, contract types, risks, and incentives ▪ Life cycle and processes and supply-chain integration ▪ Plan, execute, and control of supply-chain projects ▪ Managing connected supply chains ▪ Dealing with direct suppliers and suppliers far removed from the immediate chain ▪ Activities necessary to formally close a project ▪ Contract closure and payments	1	3

			▪ Post-completion project reviews		
8	Resources Management	a.1, b.1, c.1, c.2, d.1, d.2	What is Resource Management? Why is Resource Management important? What are the Benefits of using Resource Management? What are Resource Management Techniques? ▪ Resource planning: estimating and balancing ▪ Identifying and acquiring the required human resources, including supplier resources ▪ Identifying and scheduling resources ▪ Estimating durations ▪ Documenting team roles and responsibilities ▪ Identifying and acquiring the required equipment, materials, and resources ▪ Managing resources, including equipment, materials, and the project team ▪ Decision-making tradeoff when experiencing resource and schedule constraints ▪ Tools and techniques for resource management, including organizational breakdown structures and responsibility assignment matrices ▪ Staffing, training, and development of resources ▪ Global teams and networks	2	6
9	Project Execution: - Project Monitoring - Quality management	a.1, b.1, c.1, c.2, d.1, d.2	▪ Project Control Enablers ▪ Project Plan Development ▪ Schedule Development ▪ Project Control ▪ Risk, change, and performance control ▪ Quality's Foundations ▪ Quality Planning for Customer Satisfaction ▪ Project requirements and identification of metrics to manage quality ▪ Quality assurance tools including Ishikawa diagrams, control charts, and audits ▪ Quality Control Concepts and techniques ▪ Managing changes and quality ▪ Putting it All Together: Building a Quality Management Plan	2	6

10	- Project team management, - Client management,	a.1, b.1, c.1, c.2, d.1, d.2	▪ Team-building processes and challenges ▪ Launching a team, including goal setting, process definition, and kickoff meetings ▪ Principles of motivation, motivational theories, and leadership styles ▪ Identifying, categorizing, and prioritizing stakeholders ▪ Gathering information about stakeholders ▪ Project progress and performance ▪ Project tracking and monitoring.	1	3
11	- General Revision - Term project submission and - Presentations.	a.1, b.1, c.1, c.2, d.1, d.2		1	3
Number of Weeks /and Units Per Semester				**14**	**42**

B - Seminar	**NA**			
Order	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**	**Learning Outcomes**
1.				
2.				
3.				
Number of Weeks /and Units Per Semester				

IX. Teaching Strategies of the Course

- Lectures
- Interactive Sessions (Brainstorming Sessions, Discussions, etc.)
- Team Working Sessions
- Active Learning Approaches (Searching, case studies, presentations...)

V. Schedule of Assessment Tasks for Students During the Semester

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments and Quizzes	3 - 15	30	20% - 30%	a.1, b.1, c.1,

2	Mid-Term Exam	8	20	20% - 30%	c.2, d.1, d.2
3	Final Exam	16	50	50% - 60%	
Total			100	100%	

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	• Readings: Each week readings; based on each reading/topic, a written assignment will be issued. Students will be asked to write synthetic essays and/or complete analyses pertaining to the reading materials. These will be short (>4, <5 pages double spaced) pieces. • Each work assigned for reading will have 1 or 2 presenters assigned to it from the class. • In general students will be asked to describe the main points of the paper and to offer a critique of the contents. • Students are expected to prepare for class by reading the assigned reading prior to the class for which they are listed, and to participate in class sessions/group discussions.		3 - 14	20

VIII Learning Resources and Facilities

1- Required Textbook(s)

- PMI (2017). A Guide to the Project Management Body of Knowledge - PMBOK: (6th ed.). Project Management Institute, Newtown Square, PA, USA

2- Essential References

- Heerkens, G.R. (2002). Project Management. The McGraw-Hill Companies, Inc., NY: USA
- Verzuh, E. (2003). The Portable MBA in Project Management, John Wiley & Sons, Inc., Hoboken, NJ: USA.
- William G. Ramroth, (2006), Project Management for Design Professionals,
- Sidney M. Levi, (2006), Project Management in Construction, Me Grow Hill Professional.
- Gang Chen, (2009), Architectural Practice Simplified: A Survival Guide and Checklists for Building Construction and A16 Site Improvements as well as Tips on Architecture, Building Design, Construction and Project Management,

3- Electronic Materials and Websites *etc.*

- Course Power Point.
- Video clips.
- Links to information resources:
  - https://www.invensislearning.com/blog/5-phases-project-management-lifecycle/
  - https://www.projectmanagement.ie/blog/project-life-cycle/

- https://www.projectmanagement.ie/blog/resource-management/
-

I. Course Policies
Unless otherwise stated, the normal course administration policies and rules of the Faculty of Engineering apply. For the policy, see: ----------

Educational and research Facilities and Equipment Required
Technology Resources **(AV, data show, Smart Board, software, etc.)**
Datashow, Whiteboard, Software
Other Resources **(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)**
-

1	• **Class Attendance** A student should attend not less than 75 % of total hours of the course; 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 a proof statement from university clinic.
2	• **Tardy** For being late in attending the class, the student will be initially notified. If he/she 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 an 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 and Projects** Assignments are given to the students after each chapter; students have to submit all assignments for checking on time.
5	• **Cheating** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study, the student will be dismissed 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 proofed a plagiarism of a student, he will be dismissed from the faculty. The final dismissal of the student from the faculty should be confirmed by the Student Council Affairs 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 may be given directly to students using soft and/or hard copy**.**

Course Plan (Syllabus) Advance Project Management

II. - Information about Faculty Member Responsible for the Course							
Name of Faculty Member	Prof. Dr. Eng. Wael A. Alaghbari	**Office Hours**					
Location & Telephone No.	Faculty of Engineering Mobile: 777869168	SAT	SUN	MON	TUE	WED	THU
E-mail	wael.aghbari@gmail.com						

III. Course Identification and General Information						
1-	Course Title:	**Advance Project Management**				
2-	Course Number & Code:	FR502				
3-	Credit hours:	C.H				Total
		Th.	Seminar	Pr.	F. Tr.	
		3	-	-	-	3
4-	Study level/year at which this course is offered:	M.Sc. in All Engineering program				
5-	Pre –requisite:	-				
6-	Co –requisite (if any):	None				
7-	Program (s) in which the course is offered	M.Sc. in Architectural Engineering				
8-	Language of teaching the course:	English				
9-	System of Study:	Regular				
10-	Mode of delivery:	Face-to-Face				
11-	Location of teaching the course:	Faculty of Engineering				

IV. Course Description

This course introduces the student to basic methodologies and analytical methods for project design and implementation in various industries, in addition to providing the student with a clear understanding of how to organize and manage the necessary resources within the specified scope of work, time, cost, quality requirements, and within acceptable levels of risk. This course introduces the principles of project management and their applications in various project processes. The knowledge that the student acquires from studying this course also enables the student to easily apply various management theories in their own projects to achieve results within the specified objectives.

Intended Learning Outcomes (ILOs) of the Course	
a1	• Demonstrate holistic understanding of the principal components and concepts of project management and applications of good management practices to enhance innovation and maintain competitiveness
b1	• Evaluate project processes, and using necessary tools and effectively address the challenges that will be faced during the project, in order to make better decisions, develop and implement plans and strategies.
c1	• Apply knowledge, skills and management techniques to solve problems, implement contemporary projects and operations effectively and efficiently.
c2	• Use core engineering management concepts flexibly in a variety of contexts to meet the important technical and management needs of private and public organizations.
d1	• Demonstrate awareness of professional and ethical responsibility during execute and manage the project processes
d2	• Gain new skills of self-development, developing effective communication and leadership skills

V. Course Contents

A – Theoretical Aspects

Order	Topics List	Week Due	Contact Hours
1.	Introduction: What is a project and project management? What is a role of Project manager, duties and responsibilities? Purpose of Project Management	W1	3
2.	Project phases and project life cycle.	W2	3
3.	Project Planning	W3	3
4	Project Time management:	W4-W5	6
5	Project Cost Management: (Bill of Quantities).	W6	3
6	Clients and Contracts. Managing design development.	W7	3
7	**Mid-term exam.**	W8	3
8	Managing procurement process (design/ supervision services).	W9	3
9	Resources Management	W10-W11	6
10	Project Execution: - Project Monitoring - Quality management	W12-W13	6
11	- Project team management, - Client management,	W14	3
12	- General Revision - Term project submission and Presentations.	W15	3
13	**Final Exam**	W16	3
Number of Weeks and Units Per Semester		**16**	**48**

B – Seminar **NA**

Order	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes

1.				
2.				
3.				
Number of Weeks /and Units Per Semester				

VI. Teaching Strategies of the Course

- Lectures
- Interactive Sessions (Brainstorming Sessions, Discussions, etc.)
- Team Working Sessions
- Active Learning Approaches (Searching, case studies, presentations ...)

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.	Assignments and Quizzes	3 - 15	30	20% - 30%	a.1, b.1, c.1, c.2, d.1, d.2
2.	Mid -Term Exam	8	20	20% - 30%	
3.	Final Exam	16	50	50% - 60%	
Total			100	100%	

VIII. Learning Resources

1- Required Textbooks

- PMI (2017). A Guide to the Project Management Body of Knowledge - PMBOK: (6th ed.). Project Management Institute, Newtown Square, PA, USA

2- Essential References

- Heerkens, G.R. (2002). Project Management. The McGraw-Hill Companies, Inc., NY: USA
- Verzuh, E. (2003). The Portable MBA in Project Management, John Wiley & Sons, Inc., Hoboken, NJ: USA.
- William G. Ramroth, (2006), Project Management for Design Professionals,
- Sidney M. Levi, (2006), Project Management in Construction, Me Grow Hill Professional.
- Gang Chen, (2009), Architectural Practice Simplified: A Survival Guide and Checklists for Building Construction and A16 Site Improvements as well as Tips on Architecture, Building Design, Construction and Project Management,

3- Electronic Materials and Web Sites *etc*.

- Websites:
  - https://www.invensislearning.com/blog/5-phases-project-management-lifecycle/
  - https://www.projectmanagement.ie/blog/project-life-cycle/
  - https://www.projectmanagement.ie/blog/resource-management/

- Course Power Point.
- Video clips.

- Links to information resources.

IX. Course Policies	
Unless otherwise stated, the normal course administration policies and rules of the Faculty of Engineering apply. For the policy, see: ----------	
1	• **Class Attendance** A student should attend not less than 75 % of total hours of the course; 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 a proof statement from university Clinic.
2	• **Tardy** For being late in attending the class, the student will be initially notified. If he/she 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 an 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 and Projects** Assignments are given to the students after each chapter; students have to submit all assignments for checking on time.
5	• **Cheating** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study, the student will be dismissed 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 proofed a plagiarism of a student, he will be dismissed from the faculty. The final dismissal of the student from the faculty should be confirmed by the Student Council Affairs 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 may be given directly to students using soft and/or hard copy**.**