52.Course Specification of Mechatronics System Design

I.Course Identification and General Information:

.1	Course Title:	Mechatronics System Design.				
.2	Course Code & Number:	MT403.				
.3	Credit Hours:	C.H.				TOTAL CR. HRS.
		Th.	Seminar	Pr.	Tu.	
		2	-	2	-	3
.4	Study Level/ Semester at which this Course is offered:	Fifth Year - First Semester.				
.5	Pre –Requisite (if any):	Industrial Instrumentation and Measurements, Electrical Machines (2), Digital Control System, Embedded System and Interfacing and Industrial Automation.				
.6	Co –Requisite (if any):	None.				
7.	Program (s) in which the Course is offered:	Mechatronics Engineering Program.				
.8	Language of Teaching the Course:	English Language.				
.9	Location of Teaching the Course:	Mechatronics Engineering Department.				
.10	Prepared by:	Asst. Prof. Dr. Hatem Al-Dois.				
11.	Date of Approval:					

II.Course Description:

This course is offered to provide students with the experience, confidence and competence in the design and implementation process of mechatronics systems. It allows students to integrate their knowledge of mechanics, electronics, electrical engineering, measurement systems, programming, and control into designing comprehensive mechatronic systems. Topics of this course include modeling methods of mechatronics systems, sensing and measurement of mechanical motion, sensor selection, electromechanical actuator selection and specification, software and hardware architecture of typical modern microcontrollers for mechatronics systems. The course includes practical labs and course-project work that will prepare students for the final year graduation project, by enhancing planning and team work skills as well as the building of prototypes. The course-project must incorporate all elements of mechatronics, namely, mechanical design, electrical and electronics, computers and software.

Head of the Department Assoc. Prof. Dr. Abdul-Malik Momin	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

III.Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1.	Describe an understanding of the integration process of mechanics, control, electronics, programming and measurement systems into valuable mechatronics systems.	A2
a2.	Identify the important characteristics of sensors, actuators, signal conditioning and control devices used in mechatronics systems.	A4
a3.	Express the environmental and social development issues as well as management and sustainable development principles in designing useful mechatronics products.	A7
b1.	Analyze creative mechatronics solutions to practical industrial problems.	B3
b2.	Formulate design specifications for different components of mechatronics systems.	B4
b3.	Propose an appropriate controller, control method, and signal conditioning device for a mechatronics product based on fundamental standards.	B5
c1.	Implement computer software/hardware, electronics, and mechanical devices to develop mechatronics systems for specific tasks.	C3
c2.	Apply products life cycle design principles during the development of new mechatronics products.	C5
d1.	Co-operate as a part of a team in designing and prototyping a mechatronics project for particular purposes.	D1
d2.	Estimate commitment to tasks and an awareness of ethical principles in the design and implementation of new mechatronics systems.	D4
d3.	Review an effective and clear technical report about the project design.	D6

(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. Describe an understanding of the process of integration control, electronics, mechanics, and measurement programming valuable mechatronics systems into systems.	• Active Lectures. • Case Studies.	• Written Assessments.
a2. Identify the important characteristics of sensors, actuators, signal	• Active Lectures.	• Written Assessments. • Case Studies.

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conditioning and control devices systems. used in mechatronics	• Independent Learning. • Case Studies.	
Express the environmental and **a3.** development issues as well as social and sustainable management development principles in designing useful mechatronics products.	• Group Learning. • Case Studies.	• Short Essays.

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

Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
Analyze creative **b1.** solutions to mechatronics practical industrial problems.	• Independent Learning and Work. • Independent Applications of Engineering Analysis.	• Simulations. • Practical Assessment.
Formulate design **b2.** specifications for different components of systems. mechatronics	• Active Lectures (supported with discussions). • Hands-on Laboratory Work.	• Written Assessment.
Propose an appropriate **b3.** controller, control method, and signal conditioning device for a mechatronics product based on fundamental standards.	• Hands-on Laboratory Work. • Case Studies. • Computer and Web-Based Learning.	• Written Assessment. • Project Reports. • Case Studies.

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
software/hardware, Implement computer **c1.** and mechanical devices to develop electronics, systems for specific tasks. mechatronics	• Hands-on Laboratory work.	• Simulations. • Practical Assessment.

	• Group Learning and Problem-Based Learning. • Computer and Web-Based Learning. • Design Work and Projects.	• Project Reports. • Laboratory Reports.
c2. Apply products life cycle design development of new principles during the mechatronics products.	• Case Studies. • Design Work and Projects.	• Short essays. • Presentations .

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
d1. Co-operate as a part of a team designing and in mechatronics prototyping a project for a particular purpose.	• Group Learning. • Design Work and Projects.	• Practical Assessment. • Project Reports.
d2. Estimate commitment to tasks an awareness of ethical and principles in the design and implementation of new mechatronics systems.	• Independent Learning and Work. • Group Learning. • Seminars.	• Presentations. • Project Reports.
d3. Review an effective and clear technical report about a design project.	• The Use of Communication and Information Technology. • Design Work and Projects.	• Project Reports.

IV.Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction.	a1, a3	• Introduction to Mechatronics System Design. • Difference Between MSD and Traditional Design Methods. • Key Elements of Mechatronics Systems. • The Mechatronics Design Process.	2	4
2.	Modeling and Simulation of Mechatronics Systems.	a1	• Mathematical Modeling of Physical Elements/Systems. • Operator Notation. • Transfer Functions. • Block Diagram Modeling: • Direct Method. • Analogy Approach. • Modeling of: • Electrical Systems. • Translational Mechanical Systems. • Rotational Mechanical Systems. • Electro-Mechanical Systems	2	4
3.	Sensors and Transducers for Mechatronics Systems.	a2, b2	• Introduction. • Sensors for Motion, Position, Force, Torque, Flow, Temperature Measurements. • Tactile, Vibration, and Acceleration Sensors. • Digital Sensors.	2	4

			• Sensitivity Analysis of Components Variations. • Smart and Intelligent Sensors. • Selection of a Proper Sensor.		
4.	Actuating Devices.	a2, b2	• Electrical Actuators: Types and Characteristics. • DC Motors. • AC Motors. • Stepper Motors. • Servomotors. • Piezoelectric Actuators. • Control of Actuating Devices. • Selecting an Appropriate Actuator. • Practical Examples.	2	4
5.	Mid-Term Exam.	a1, a2, a3, b1, b2	• The First Four Chapters.	1	2
6.	Signal Conditioning and Real-Time Interfacing.	a1, a2, b1, b2	• Elements of a Data Acquisition and Control System. • Transducers and Signal Conditioning. • Devices for Data Conversion. • A/D Converters & D/A Converters. • Data Conversion Process. • Data Acquisition and Control. • Virtual Instrumentation. • Application Software.	2	4
7.	Control of Mechatronics Systems.	a2, b1, b2, b3	• Basic Control Logic. • Open-Loop Response. • Feedback Control.	2	4

			• Controller Design for Mechatronics Systems. • Microcontrollers, PC-Based Controller, PLCs, DSPs, Single-Board Computer, and Personal Computers. • Distributed Control, Discrete and Hybrid Control Systems. • Controller Empirical Design. • Controller Implementation. • Selecting Appropriate Controller and Control Algorithm.		
8.	Mechatronic Systems Case Studies.	a1, a2, a3, c1, c2, d3	• Comprehensive Case Studies. • Data Acquisition Case Studies. • Control Systems Case Studies.	2	4
9.	Final Exam.	a1, a2, a3, b1, b2, b3, c2	• All the chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Learning Outcomes	Weeks	Contact Hours
1.	**Sensors and Transducers Lab.** - Experimental characterization of different sensors**.**	b1, b2, c1, d1, d2, d3	3	6
2.	**Actuating Devices Lab.** - System identification of any one of the actuators**.**	b1, b2, c1, d1, d2, d3	3	6

3.	**Automatic Control Lab.** - Experiment on image based navigation and control of robot. - Experiment on control of non-linear systems**.** - Experiment on control of inverted pendulum**.** - Development of transfer function based on experimentally identified data, Stability analysis of predicted transfer function, and PID tuning and implementation on experimental setup.	b1, b2, b3, d1, d2, d3	3	6
4.	**Modeling and Simulation Lab**. - Experimental identification of mechanisms such as flexural based systems etc. - Experiment on system identification and control of scanning mechanism. - Experimental Identification by frequency response approach of Mechanical, Electrical, Chemical system. - Experiment based on waveform generation interfacing and control of motors etc.	b1, b3, c1, d1, d2, d3	2	4
5.	Course Project.	b1, b2, b3, c1, c2, d1, d2, d3	3	6
Number of Weeks /and Units Per Semester			**14**	**28**

V.Teaching Strategies of the Course:

- The teaching strategies of the course are as follows:
- Active Lectures (supported with discussions).
- Case Studies.
- Problem-Based Learning.
- Independent Learning.
- Group Learning.
- The Use of Communication and Information Technology.
- Computer and Web-Based Learning.
- Independent Applications of Engineering Analysis.
- Hands-on Laboratory Work.
- Design Work and Projects.
- Seminars.

VI.Assessment Methods of the Course:

The assessment methods of the course are as follows:

- Written Assessments.
- Short Essays.
- Simulations.
- Laboratory Reports.
- Presentations.
- Practical Assessment.
- Case Studies.
- Project Reports.

VII.Assignments:

Order	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1.	Assignment 1: Complete Model of a Mechatronics System.	a1, a2, b1, b2, b3, d2, d3	5	4
2.	Assignment 2: Control Methods of Mechatronics Systems	a1, a2, b1, b2, b3, d2, d3	11	3.5
Total				**7.5**

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

Order	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs
1.	Assignments.	5, 11	7.5	5%	a1, a2, b1, b2, b3, d2, d3
2.	Quizzes.	7, 13	7.5	5%	a1, a2, a3, b1, b2
3.	Mid-Term Exam.	9	15	10%	a1, a2, a3, b1, b2
4.	Lab. Reports.	3, 6, 9, 11	15	10%	b1, b2, b3, c1, d1, d2, d3
5.	Project Report and Presentation.	14	30	20%	b1, b2, b3, c1, c2, d1, d2, d3
6.	Final Exam.	16	75	50%	a1, a2, a3, b1, b2, b3, c2
Total			**150**	**100%**	

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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. Devdas Shetty, 2011, Mechatronics System Design, SI Version, 2nd Edition, USA, CENGAGE Learning.
2. R. Isermann, 2005, Mechatronic Systems: Fundamentals, Berlin, Springer.

2- Essential References.

1. David G. Alciatore and Michael B. Histand, 2012, Introduction to Mechatronics and Measurement Systems, 4th Edition, , NY, USA McGraw-Hill.
2. William Bolton, 2011, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 5 th edition, Essex, England: Pearson.
3. Robert H. Bishop, 2008, The Mechatronics Handbook - Mechatronic Systems, Sensors and Actuators, Florida, USA, CRC Press.
4. Clive L. Dym and Patrick Little, 2009, Engineering Design: A Project-Based Introduction, 3rd edition, New York: John Wiley & Sons.
5. Dan Necsulescu, 2001, Mechatronics, 1st Edition, NJ, USA, Prentic Hall.
6. Georg Pelz, 2003, Mechatronic Systems Modeling and Simulation with HDLs, 1st Edition, , UK, John Wiley & Sons Ltd.
7. David G. Ullman, 2009, The Mechanical Design Process, 4th edition, Boston, MA, McGraw-Hill.
8. Sabri Cetinkunt, 2006, Mechatronics, 1st Edition, UK, Wiley & Sons Ltd.
9. Ahmad Smaili, Fouad Mrad, 2008, Applied Mechatronics, 1st Edition, UK, Oxford University Press.

3- Electronic Materials and Web Sites etc.

1- Website: Mechatronics Design Center
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1482
2- Website: Mechatronics Demonstration Kit
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDoc Name=en023837&part=D
3- Website: Motion system design
http://www.motionsystemdesign.com/
4- Website: Robotics and Mechatronics Network
http://kn.theiet.org/communities/robotics/index.cfm
5- Website: Peter Corke, Robotics Toobox for MATLAB
http://petercorke.com/wordpress/

Online Magazines

1. EDN (Electronic Design News)
http://www.edn.com

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2. Embedded Systems
   http://www.embedded.com/
3. IEEE Spectrum
   http://spectrum.ieee.org
4. Machine Design
   http://www.machinedesign.com

Journals

Mechatronics, The Science of Intelligent Machines, A journal of IFAC, the International Federation of Automatic Control, Elsevier.
https://www.sciencedirect.com/journal/mechatronics/about/aims-and-scope

X.Course Policies:

1.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the Faculty.
2.	Tardy: **The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.**
3.	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for mid-term exam and final 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**: If any cheating occurred during the examination, the student is not allowed to continue and the examination committee for enquiries . he has to face
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attend the exam on another university. behalf according to the policy, rules and regulations of the
7.	**Other policies:** • All the teaching materials should be kept out the examination hall. • The mobile phone is not allowed. • There should be a respect between the student and his teacher.

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. Head of Mechatronics Engineering Department: Assoc. Prof. Dr. Abdul-Malik Momin.
	Deputy Rector for Academic Affairs Assoc. Prof. Dr. Ibrahim AlMutaa. Assoc. Prof. Dr. Ahmed Mujahed. Asst. Prof. Dr. Munaser Alsubari.

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Course Plan of Mechatronics System Design

I.Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Asst. Prof. Dr. Hatem Al-Dois.	**Office Hours**					
Location& Telephone No.	7746 77493.	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	haldois@yahoo.com.						

II.Course Identification and General Information:

.1	Course Title:	Mechatronics System Design.				
.2	Course Code & Number:	MT403.				
.3	Credit Hours:	C.H.				Total CR. HRS.
		Th.	Seminar	Pr.	Tu.	
		2	--	2	--	3
.4	Study Level/ Semester at which this Course is Offered:	Fifth Year - First Semester.				
.5	Pre –requisite (if any):	Industrial Instrumentation and Measurements, Electrical Machines (2), Digital Control System, Embedded System and Interfacing and Industrial Automation.				
.6	Co –requisite (if any):	None.				
7.	Program (s) in which the Course is Offered:	Mechatronics Engineering Program.				
8.	Language Teaching the Course:	English Language.				
.9	System of Study:	Semesters.				
10.	Mode of Delivery:	Lectures and Labs.				
11.	Location of Teaching the Course:	Mechatronics Engineering Department.				

III.Course Description:

This course is offered to provide students with the experience, confidence and competence in the design and implementation process of mechatronics systems. It allows students to integrate their knowledge of mechanics, electronics, electrical engineering, measurement systems, programming,

and control into designing comprehensive mechatronic systems. Topics of this course include modeling methods of mechatronics systems, sensing and measurement of mechanical motion, sensor selection, electromechanical actuator selection and specification, software and hardware architecture of typical modern microcontrollers for mechatronics systems. The course includes practical labs and course-project work that will prepare students for the final year graduation project, by enhancing planning and team work skills as well as the building of prototypes. The course-project must incorporate all elements of mechatronics, namely, mechanical design, electrical and electronics, computers and software.

IV.Course Intended learning outcomes (CILOs) of the course		**Referenced PILOs**
a1.	Describe an understanding of the integration process of mechanics, control, electronics, programming and measurement systems into valuable mechatronics systems.	A.2
a2.	Identify the important characteristics of sensors, actuators, signal conditioning and control devices used in mechatronics systems.	A.4
a3.	Express the environmental and social development issues as well as management and sustainable development principles in designing useful mechatronics products.	A.7
b1.	Analyze creative mechatronics solutions to practical industrial problems.	B.3
b2.	Formulate design specifications for different components of mechatronics systems.	B.4
b3.	Propose an appropriate controller, control method, and signal conditioning device for a mechatronics product based on fundamental standards.	B.5
c1.	Implement computer software/hardware, electronics, and mechanical devices to develop mechatronics systems for specific tasks.	C.3
c2.	Apply products life cycle design principles during the development of new mechatronics products.	C.5
d1.	Co-operate as a part of a team in designing and prototyping a mechatronics project for particular purposes.	D.1
d2.	Estimate commitment to tasks and an awareness of ethical principles in the design and implementation of new mechatronics systems.	D.4
d3.	Review an effective and clear technical report about the project design.	D.6

V.Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction.	• Introduction to Mechatronics System Design. • Difference Between MSD and Traditional Design Methods. • Key Elements of Mechatronics Systems. • The Mechatronics Design Process.	1,2	4

2.	Modeling and Simulation of Mechatronics Systems.	• Mathematical Modeling of Physical Elements/Systems.
		• Operator Notation.
		• Transfer Functions.
		• Block Diagram Modeling:
		  ○ Direct Method.
		  ○ Analogy Approach.
		• Modeling of:
		  ○ Electrical Systems.
		  ○ Translational Mechanical Systems.
		  ○ Rotational Mechanical Systems.
		  ○ Electro-Mechanical Systems.
			3.4	4

3.	Sensors and Transducers for Mechatronics Systems.	• Introduction. • Sensors for Motion, Position, Force, Torque, Flow, Temperature Measurements. • Tactile, Vibration, and Acceleration Sensors. • Digital Sensors. • Sensitivity Analysis of Components Variations. • Smart and Intelligent Sensors. • Selection of a Proper Sensor.	5,6	4

4.	Actuating Devices.	• Electrical Actuators: Types and Characteristics:
		  ○ DC Motors.
		  ○ AC Motors.
		  ○ Stepper Motors.
		  ○ Servomotors.
		  ○ Piezoelectric Actuators.
		• Control of Actuating Devices.
		• Selecting an Appropriate Actuator.
		• Practical Examples.
			7,8	4

5.	Mid-Term Exam.	The First 4 Chapters.	9	2
6.	Signal Conditioning and Real-Time Interfacing.	• Elements of a Data Acquisition and Control System. • Transducers and Signal Conditioning. • Devices for Data Conversion. • A/D Converters & D/A Converters. • Data Conversion Process. • Data Acquisition and Control. • Virtual Instrumentation. • Application Software.	10,11	4
7.	Control of Mechatronics Systems.	• Basic Control Logic. • Open-Loop Response. • Feedback Control. • Controller Design for Mechatronics Systems. • Microcontrollers, PC-Based Controller, PLCs, DSPs, Single-Board Computer, and Personal Computers. • Distributed Control, Discrete and Hybrid Control Systems. • Controller Empirical Design. • Controller Implementation. • Selecting Appropriate Controller and Control Algorithm.	12,13	4
8.	Mechatronic Systems Case Studies.	• Comprehensive Case Studies • Data Acquisition Case Studies • Control Systems Case Studies	14,15	4
9.	Final Exam.	All the Chapters.	16	2

Number of Weeks /and Units Per Semester	**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Learning Outcomes	Weeks	Contact Hours
1.	**Sensors and Transducers Lab.** - Experimental characterization of different sensors.	b1, b2, c1, d1, d2, d3	1,2,3	6
2.	**Actuating Devices Lab.** - System identification of any one of the actuators.	b1, b2, c1, d1, d2, d3	4,5,6	6
3.	**Automatic Control Lab.** - Experiment on image based navigation and control of robot. - Experiment on control of non-linear systems. - Experiment on control of inverted pendulum. - Development of transfer function based on experimentally identified data, Stability analysis of predicted transfer function, and PID tuning and implementation on experimental setup.	b1, b2, b3, d1, d2, d3	7,8,9	6
4.	**Modeling and Simulation Lab**. - Experimental identification of mechanisms such as flexural based systems etc. - Experiment on system identification and control of scanning mechanism. - Experimental Identification by frequency response approach of Mechanical, Electrical, Chemical system. - Experiment based on waveform generation, interfacing and control of motors etc.	b1, b3, c1, d1, d2, d3	10,11	4
5.	Course Project.	b1, b2, b3, c1, c2, d1, d2, d3	12,13, 14	6
Number of Weeks /and Units Per Semester			**14**	**28**

VI.Teaching Strategies of the Course:

The teaching strategies of the course are as follows:

- Active Lectures (supported with discussions).
- Case Studies.

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- Problem-Based Learning.
- Independent Learning.
- Group Learning.
- The Use of Communication and Information Technology.
- Computer and Web-Based Learning.
- Independent Applications of Engineering Analysis.
- Hands-on Laboratory Work.
- Design Work and Projects.
- Seminars.

VII.Assignments:

Order	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1.	Assignment 1: Complete Model of a Mechatronics System.	a1, a2, b1, b2, b3, d2, d3	5	4
2.	Assignment 2: Control Methods of Mechatronics Systems.	a1, a2, b1, b2, b3, d2, d3	11	3.5
Total				**7.5**

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

Order	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs
1.	Assignments.	5, 11	7.5	5%	a1, a2, b1, b2, b3, d2, d3
2.	Quizzes.	7, 13	7.5	5%	a1, a2, a3, b1, b2
3.	Mid-Term Exam.	9	15	10%	a1, a2, a3, b1, b2
4.	Lab. Reports.	3, 6, 9, 11	15	10%	b1, b2, b3, c1, d1, d2, d3
5.	Project Report and Presentation.	14	30	20%	b1, b2, b3, c1, c2, d1, d2, d3
6.	Final Exam.	16	75	50%	a1, a2, a3, b1, b2, b3, c2
Total			**150**	**100%**	

IX.Learning Resources:

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

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

1. Devdas Shetty, 2011, Mechatronics System Design, SI Version, 2nd Edition, USA, CENGAGE Learning.
2. R. Isermann, 2005, Mechatronic Systems: Fundamentals, Berlin, Springer.

2- Essential References.

1. David G. Alciatore and Michael B. Histand, 2012, Introduction to Mechatronics and Measurement Systems, 4th Edition, , NY, USA McGraw-Hill.
2. William Bolton, 2011, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 5th edition, Essex, England: Pearson.
3. Robert H. Bishop, 2008, The Mechatronics Handbook - Mechatronic Systems, Sensors and Actuators, Florida, USA, CRC Press.
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7. David G. Ullman, 2009, The Mechanical Design Process, 4th edition, Boston, MA, McGraw-Hill.
8. Sabri Cetinkunt, 2006, Mechatronics, 1st Edition, UK, Wiley & Sons Ltd.
9. Ahmad Smaili, Fouad Mrad, 2008, Applied Mechatronics, 1st Edition, UK, Oxford University Press.

3- Electronic Materials and Web Sites etc.

1. Website: Mechatronics Design Center
2. http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1482
3. Website: Mechatronics Demonstration Kit
4. http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDoc Name=en023837&part=D
5. Website: Motion system design
6. http://www.motionsystemdesign.com/
7. Website: Robotics and Mechatronics Network
8. http://kn.theiet.org/communities/robotics/index.cfm
9. Website: Peter Corke, Robotics Toobox for MATLAB
10. http://petercorke.com/wordpress/

Online Magazines

1. EDN (Electronic Design News)
2. http://www.edn.com
3. Embedded Systems
4. http://www.embedded.com/
5. IEEE Spectrum
6. http://spectrum.ieee.org

7. Machine Design
8. http://www.machinedesign.com

Journals

1. Mechatronics, The Science of Intelligent Machines, A journal of IFAC, the International Federation of Automatic Control, Elsevier.
2. https://www.sciencedirect.com/journal/mechatronics/about/aims-and-scope

X.Course Policies:

1.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the Faculty.
2.	Tardy: **The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.**
3.	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for mid-term exam and final 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**: If any cheating occurred during the examination, the student is not allowed to continue and he has to face the examination committee for enquiries .
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attend the exam on another university. behalf according to the policy, rules and regulations of the
7.	**Other Policies:** • All the teaching materials should be kept out the examination hall. • The mobile phone is not allowed. • There should be a respect between the student and his teacher.