Sana'a University
Faculty of Engineering
Mechatronics Engineering Department
Mechatronics Engineering Program

Course Specification of Engineering Mechanics 1 (Statics)

I. Course Identification and General Information:

1.	Course Title:	Engineering Mechanics 1 (Statics).				
2.	Course Code & Number:	BR007.				
3.	Credit hours:	C.H.				TOTAL C.R.
		Th.	Seminar	Pr	Tu.	
		2	-	-	2	3
4.	Study level/ semester at which this course is offered:	First Year -First Semester.				
5.	Pre –requisite (if any):	-				
6.	Co –requisite (if any):	Mathematics and Physics.				
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:	Associate Prof. Dr. Abdul-Malik Momin.				
11.	Date of Approval:					

II. Course Description:

This course provides a basic understanding of the part of mechanics which is concerned with the equilibrium of bodies under the action of forces. Topics covered include basic concepts of mechanics and vectors; forces and force systems and their external effects on bodies, principally the condition of equilibrium of two-and three-dimensional systems; free-body diagrams and equilibrium of particles and bodies; moments; couples; structural analysis and trusses; distributed forces; center of mass; centroids; friction and application of frictional forces. The formulation and solution of mechanics problems will help the students for developing the ability of logical thinking and effective communication. In each chapter, the complete theory and the method of analysis will be introduced in the beginning followed by solved examples and assignments.

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Ass. Prof. Dr. Abdul-Malik Momin	Ass. Prof. Dr. Abdul-Malik Momin	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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III.Course Intended learning outcomes (CILOs) of the course		**Referenced PILOs**
a1.	Establish the basic principles of engineering mechanics with the support of mathematics.	A1
a2.	Identify static problems with different methodologies.	A3
b1.	Categorize mechatronics problems with the support of the present subject.	B1
b2.	Analyze the problems related to the real application	B2
b3.	Explore innovative solutions to support industrial applications.	B3
c1.	Compute engineering problems with the support of the software.	C2
d1.	Co-operate with team members to share different knowledge.	D1
d2.	Defend to tasks with the support of the different resources.	D3

(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. Establish the basic principles of engineering mechanics with the support of mathematics..	• Active Lectures. • Tutorials.	• Written Assessment. • Short Essays.
a2. Identify static problems with different methodologies.	• The use of computer and web-based learning.	• Presentation.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Categorize mechatronics problems with the support of the present subject.	• Design Work and Project. • Case Studies	• Practical Assessment. • Reports.

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b2. Analyze the problems related to the real application.	• The use of computer and web-based learning. • Case Studies.	• Practical Assessment. • Project Reports.
b3. Explore innovative solutions to support industrial applications..	• Active Lectures. • Independent Learning.	• Practical Assessment. • Presentations.

© **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. Compute engineering problems with the support of the software.	• The use of computer and web-based learning.	• 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 with team members to share different knowledge.	• Directed Self Study.	• Project Reports.
d2. Defend to tasks with the support of the different resources**.**	• Group Learning and Problem-Based Learning..	• Presentations.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction to Statics.	a1, a2,b2,d1,d2.	• Fundamental Concepts. • Units of Measurement • The International System of Units • Newton's Laws. • System of Units. • Laws of Gravitations.	1	2

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			• Unit Vector.		
2.	Force Vectors.	a2,b1,b2,d1, d2.	• Scalars and Vectors. • Vector Operations. • Vector Addition of Forces. • Addition of a System of Coplanar Forces • Cartesian Vectors. • Position Vectors. • Force Vector Directed Along a Line. • Dot Product.	2	4
3.	Equilibrium of a Particle.	a1,a2,b1,b2, b3,c1,d1,d2.	• Condition for the Equilibrium of a Particle. • The Free-Body Diagram. • Coplanar Force Systems. • Three –Dimensional Force Systems.	1	2
4.	Force System Resultants.	a1,a2,b1,b2, b3,c1,d1,d2.	• Moment of a Force-Scalar Formulation. • Cross Product. • Moment of a Force-Vector Formulation. • Principle of Moments. • Moment of a Couple. • Simplification of a Force and Couple System.	2	4
5.	Equilibrium of a Rigid Body.	a1,a2,b1,b2, b3,c1,d1,d2.	• Conditions for Rigid Body Equilibrium. • Free-Body Diagrams. • Equations of Equilibrium. • Two and Three Force Members. • Constraints and Statical Determinacy.	1	2
6.	Mid-Term	a1, a2, b1, b2, b3, c1	• The first 5 chapters.	1	2

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7.	Structural Analysis.	a1,a2,b1,b2, b3,c1,d1,d2.	• Simple Trusses. • The Method of Joints. • Zero Force Members. • Frames and Machines.	2	4
8	Friction.	a1,a2,b1,b2, b3,c1,d1,d2.	• Characteristics of Dry Friction. • Wedges. • Frictional Forces on Flat Belts.	1	2
9.	Center of Gravity and Centroid.	a1,a2,b1,b2, b3,c1,d1,d2.	• Center of Gravity, Center of Mass and the Centroid of a Body. • Composite Bodies.	2	4
10.	Moments of Inertia.	a1,a2,b1,b2, b3,c1,d1,d2.	• Definition of Moments of Inertia for Areas. • Moments of Inertia for Composite Areas. • Mass Moment of Inertia.	1	2
11.	Virtual Work.	a1,a2,b1,b2, b3,c1,d1,d2.	• Definition of Work. • Conservative Forces. • Potential Energy.	1	2
12.	Final Exam	a1, a2, b1, b2, b3, c1	• All the chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Introduction to Statics.	1	2	a1, a2,b2,d1,d2.
2.	Force Vectors.	2	4	a2,b1,b2,d1,d2.
3.	Equilibrium of a Particle.	1	2	a1,a2,b1,b2,b3,c1,d1,d2.
4.	Force System Resultants.	2	4	a1,a2,b1,b2,b3,c1,d1,d2.
5.	Equilibrium of a Rigid Body.	1	2	a1,a2,b1,b2,b3,c1,d1,d2.

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6.	Structural Analysis.	2	4	a1,a2,b1,b2,b3,c1,d1,d2.
7.	Friction.	1	2	a1,a2,b1,b2,b3,c1,d1,d2.
8.	Center of Gravity and Centroid.	2	4	a1,a2,b1,b2,b3,c1,d1,d2.
9.	Moments of Inertia.	1	2	a1,a2,b1,b2,b3,c1,d1,d2.
10.	Virtual Work.	1	2	a1,a2,b1,b2,b3,c1,d1,d2.
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- The use of Computer and Web-Based Learning.
- Design Work and Project.
- Case Studies.
- Independent Learning.
- Directed Self Study.
- Group Learning and Problem Based Learning.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Introduction to Statics (Tutorial 1).	a1, a2,b2,d1,d2.	First Week.	2.25
2.	Force Vectors (Tutorial 2).	a2,b1,b2,d1,d2.	Second and Third Weeks.	2.25
3.	Equilibrium of a Particle (Tutorial 3).	a1,a2,b1,b2,b3,c1,d1,d2.	Fourth Week.	2.25
4.	Force System Resultants (Tutorial 4).	a1,a2,b1,b2,b3,c1,d1,d2.	Fifth Week.	2.25
5.	Equilibrium of a Rigid Body (Tutorial 5).	a1,a2,b1,b2,b3,c1,d1,d2.	Sixth Week.	2.25

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6.	Structural Analysis (Tutorial 6).	a1,a2,b1,b2,b3,c1,d1,d2.	Seventh and Eight Weeks.	2.25
7.	Friction (Tutorial 7).	a1,a2,b1,b2,b3,c1,d1,d2.	Ninth Week.	2.25
8.	Center of Gravity and Centroid (Tutorial 8).	a1,a2,b1,b2,b3,c1,d1,d2.	Tenth and Eleventh Weeks.	2.25
9.	Moments of Inertia (Tutorial 9).	a1,a2,b1,b2,b3,c1,d1,d2.	Twelfth Week.	2.25
10.	Virtual Work (Tutorial 10).	a1,a2,b1,b2,b3,c1,d1,d2.	Thirteenth Week.	2.25
	Total			**22.5**

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.	Assessment (Work Sample such as Portfolios).	1-13	22.5	15 %	a1,a2,b1,b2,b3,c1,d1,d2.
2.	Mid-Term Exam	8	22.5	15 %	a1,a2,b1,b2,b3,c1.
3.	Final Exam.	16	105	70 %	a1,a2,b1,b2,b3,c1.
	Total		**150**	**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. J. L. Meriam, L. G. Kraige, 2011, Engineering Mechanics, Statics, 7th Edition, John Wiley Publisher.

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	2. R. C. Hibbeler, Kai Beng Yap, 2013, Engineering Mechanics, Statics, 13th Edition, Pearson Education South Asia Ltd.
2- Essential References.	
3- Electronic Materials and Web Sites *etc*.	
	1. www.coursera.org. 2. www.amazon.com 3. www.studocu.com

IX. 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 15 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.

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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 enquires.
6.	**Plagiarism:** - If one student attends the exam on another behalf; he will be dismissed from the faculty according to the policy, rules and regulations of the university.
7.	**Other policies:** - All the teaching materials should be kept out the examination hall and mobile phones are not allowed. - Mutual respect should be maintained between the student and his teacher and also among students. Failing in keeping this respect is subject to the policy, rules and regulations of the university.

Reviewed By	Vice Dean for Academic Affairs and Post Graduate Studies: Dr. Tarek A. Barakat President of Quality Assurance Unit: Ass. Prof. Dr. Mohammed Algorafi Head of Mechatronics Engineering Department: Ass. Prof. Dr. Abdul-Malik Momin Ass. Prof. Dr. Riyadh Muharam.
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa Ass. Prof. Dr. Ahmed Mujahed Dr. Munaser Alsubri

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Template for Course Plan of Engineering Mechanics 1-Statics

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member	Dr. Abdul-Malik Momin	**Office Hours**						
Location& Telephone No.	Mechatronics Engineering Department 777943334.	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**	
E-mail	dramalikmomin@yahoo.com							

II. Course Identification and General Information:						
1-	Course Title:	Engineering Mechanics (Statics).				
2-	Course Number & Code:	BR007.				
3-	Credit hours:	**C.H**				**Total Credit Hours**
		Th.	**Seminar**	**Pr.**	**Tu.**	
		2	-	-	2	3
4-	Study level/year at which this course is offered:	First Year- First Semester.				
5-	Pre –requisite (if any):	-				
6-	Co –requisite (if any):	Mathematics and Physics.				
7-	Program (s) in which the course is offered	Mechatronics Engineering Program.				
8-	Language of teaching the course:	English Language.				
9-	System of Study:	Semesters.				
10-	Mode of delivery:	Lectures and Tutorials.				
11-	Location of teaching the course:	Mechatronics Engineering Department.				

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III. Course Description:

This course provides a basic understanding of the part of mechanics which is concerned with the equilibrium of bodies under the action of forces. Topics covered include basic concepts of mechanics and vectors; forces and force systems and their external effects on bodies, principally the condition of equilibrium of two-and three-dimensional systems; free-body diagrams and equilibrium of particles and bodies; moments; couples; structural analysis and trusses; distributed forces; center of mass; centroids; friction and application of frictional forces. The formulation and solution of mechanics problems will help the students for developing the ability of logical thinking and effective communication. In each chapter, the complete theory and the method of analysis will be introduced in the beginning followed by solved examples and assignments.

IV. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1.	Establish the basic principles of engineering mechanics with the support of mathematics.	A1
a2.	Identify static problems with different methodologies.	A3
b1.	Categorize mechatronics problems with the support of the present subject.	B1
b2.	Analyze the problems related to the real application	B2
b3.	Explore innovative solutions to support industrial applications.	B3
c1.	Compute engineering problems with the support of the software.	C2
d1.	Co-operate with team members to share different knowledge.	D1
d2.	Defend to tasks with the support of the different resources.	D3

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V.Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction to Statics.	• Fundamental Concepts. • Units of Measurement • The International System of Units • Newton's Laws. • System of Units. • Laws of Gravitations. • Unit Vector.	1	2
2.	Force Vectors.	• Scalars and Vectors. • Vector Operations. • Vector Addition of Forces. • Addition of a System of Coplanar Forces • Cartesian Vectors. • Position Vectors. • Force Vector Directed Along a Line. • Dot Product.	2,3	4
3.	Equilibrium of a Particle.	• Condition for the Equilibrium of a Particle. • The Free-Body Diagram. • Coplanar Force Systems. • Three –Dimensional Force Systems.	4	2
4.	Force System Resultants.	• Moment of a Force-Scalar Formulation. • Cross Product. • Moment of a Force-Vector Formulation. • Principle of Moments. • Moment of a Couple. • Simplification of a Force and Couple System.	5,6	4
5.	Equilibrium of a Rigid Body.	• Conditions for Rigid Body Equilibrium. • Free-Body Diagrams. • Equations of Equilibrium.	7	2

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		• Two and Three Force Members. • Constraints and Statical Determinacy.		
6.	Mid-Term Exam	• All the 5 chapters.	8	2
7.	Structural Analysis.	• Simple Trusses. • The Method of Joints. • Zero Force Members. • Frames and Machines.	9,10	4
8.	Friction.	• Characteristics of Dry Friction. • Wedges. • Frictional Forces on Flat Belts.	11	2
9.	Center of Gravity and Centroid.	• Center of Gravity, Center of Mass and the Centroid of a Body. • Composite Bodies.	12,13	4
10.	Moments of Inertia.	• Definition of Moments of Inertia for Areas. • Moments of Inertia for Composite Areas. • Mass Moment of Inertia.	14	2
11.	Virtual Work.	• Definition of Work. • Conservative Forces. • Potential Energy.	15	2
12.	Final Exam	• All the chapters.	16	2
Number of Weeks /and Units Per Semester			**16**	**32**

B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Introduction to Statics.	1	2	a1, a2,b2,d1,d2.
2.	Force Vectors.	2,3	4	a2,b1,b2,d1,d2.
3.	Equilibrium of a Particle.	4	2	a1,a2,b1,b2,b3,c1,d1,d2.
4.	Force System Resultants.	5,6	4	a1,a2,b1,b2,b3,c1,d1,d2.
5.	Equilibrium of a Rigid Body.	7	2	a1,a2,b1,b2,b3,c1,d1,d2.

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6.	Structural Analysis.	8,9	4	a1,a2,b1,b2,b3,c1,d1,d2.
7.	Friction.	10	2	a1,a2,b1,b2,b3,c1,d1,d2.
8.	Center of Gravity and Centroid.	11,12	4	a1,a2,b1,b2,b3,c1,d1,d2.
9.	Moments of Inertia.	13	2	a1,a2,b1,b2,b3,c1,d1,d2.
10.	Virtual Work.	14	2	a1,a2,b1,b2,b3,c1,d1,d2.
Number of Weeks /and Units Per Semester		**14**	**28**	

VI. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- The use of Computer and Web-Based Learning.
- Design Work and Project.
- Case Studies.
- Independent Learning.
- Directed Self Study.
- Group Learning and Problem Based Learning.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Introduction to Statics (Tutorial 1).	a1, a2,b2,d1,d2.	First Week.	2.25
2.	Force Vectors (Tutorial 2).	a2,b1,b2,d1,d2.	Second and Third Weeks.	2.25
3.	Equilibrium of a Particle (Tutorial 3).	a1,a2,b1,b2,b3,c1,d1 ,d2.	Fourth Week.	2.25
4.	Force System Resultants (Tutorial 4).	a1,a2,b1,b2,b3,c1,d1 ,d2.	Fifth Week.	2.25
5.	Equilibrium of a Rigid Body (Tutorial 5).	a1,a2,b1,b2,b3,c1,d1 ,d2.	Sixth Week.	2.25

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6.	Structural Analysis (Tutorial 6).	a1,a2,b1,b2,b3,c1,d1,d2.	Seventh and Eight Weeks.	2.25
7.	Friction (Tutorial 7).	a1,a2,b1,b2,b3,c1,d1,d2.	Ninth Week.	2.25
8.	Center of Gravity and Centroid (Tutorial 8).	a1,a2,b1,b2,b3,c1,d1,d2.	Tenth and Eleventh Weeks.	2.25
9.	Moments of Inertia (Tutorial 9).	a1,a2,b1,b2,b3,c1,d1,d2.	Twelfth Week.	2.25
10.	Virtual Work (Tutorial 10).	a1,a2,b1,b2,b3,c1,d1,d2.	Thirteenth Week.	2.25
	Total			**22.5**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assessment (Work Sample such as Portfolios).	1-13	22.5	15 %	a1,a2,b1,b2,b3,c1,d1,d2.
2.	Mid-Term Exam	8	22.5	15 %	a1,a2,b1,b2,b3,c1.
3.	Final Exam.	16	105	70 %	a1,a2,b1,b2,b3,c1.
	Total		**150**	**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).

3. J. L. Meriam, L. G. Kraige, 2011, Engineering Mechanics, Statics, 7th Edition, John Wiley Publisher.

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	4. R. C. Hibbeler, Kai Beng Yap, 2013, Engineering Mechanics, Statics, 13th Edition, Pearson Education South Asia Ltd.
2- Essential References.	
3- Electronic Materials and Web Sites *etc*.	
	4. www.coursera.org. 5. www.amazon.com 6. www.studocu.com

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 15 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.

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Prof. Dr. Al-Qassim Mohammed Abbas

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 enquires.
6.	**Plagiarism:** - If one student attends the exam on another behalf; he will be dismissed from the faculty according to the policy, rules and regulations of the university.
7.	**Other policies:** - All the teaching materials should be kept out the examination hall and mobile phones are not allowed. - Mutual respect should be maintained between the student and his teacher and also among students. Failing in keeping this respect is subject to the policy, rules and regulations of the university.

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