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An Ottoman Officer Mehmet Izzet's Mechanical Books

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Abstract

This paper concerns an Ottoman officer and translator, Mehmet İzzet's mechanical books. His books are among the most comprehensive textbooks on mechanical education in the 19th-century Ottomans. Therefore, understanding his book's contents will give the reader an insight into Ottoman mechanics education in secondary and high schools in the 19th century. Mehmet İzzet has two books, *Mebâdî-i Fenn-i Makine* (Fundamental Machine Science) in two volumes and *Fenn-i Mikanik* (Mechanical Science) about mechanics and machine science. In this article, old Ottoman texts were examined cover to cover, and tables of contents not included in the original texts were created.

Keywords

Ottoman Mechanics Education, Ottoman History of Education, Mehmet İzzet, Fenn-i Makine, Fenn-i Mikanik

1. Introduction

The Industrial Revolution in the 18th and 19th centuries harmed the Ottoman economy. The new European production technologies quickly invaded the Ottoman market and crushed Ottoman traditional local production. As a result, an economic crisis was inevitable (Dosay-Gökdoğan & Demir, 2022). The obvious solution to this problem was to adopt new technologies, for which Military Engineering Academies were founded. Many books were translated and compiled to supply textbooks for the students of the Military Engineering Academies and to the secondary schools, which prepare the students for these academies. With this encouragement, the Ottomans had a breakthrough in the publication of mechanics and machine science in the 19th century (Aslan-Seyhan, 2024).

Many of the mechanical books written in the 19th century by Ottomans were

similar in content[1]. For this reason, choosing one of the authors and examining his mechanics books in detail will mean having an idea about the content of mechanical education in the Ottoman Empire in the 19th century. This is especially important to have an opinion about Ottoman mechanics education history. It is a matter of curiosity whether there is a relationship between the content of Ottoman mechanical education and the failure of Ottoman industrialization. Although the answer to this question is beyond the scope of this article, I hope that this article can bring us one step closer to the answer.

Mehmet İzzet's books are among the most comprehensive textbooks written for mechanics education in 19th century Ottomans. For this reason, the content of his mechanical books will be presented in this article. The books mentioned in this article were examined in detail. Two-thirds of the books to be examined do not have a table of contents in their original texts. Only one of the books has the tables of contents in the original manuscript, which is incomprehensible. In order to provide the reader with complete information about the contents of the books, the books were examined from beginning to end, and tables of contents were created.

2. Mehmet İzzet's Life and Works on Mechanics

Figure 1. Mehmet İzzet (Gök, 2022).

Mehmet İzzet (**Figure 1**) born in 1867/68 in Istanbul. He lived in the Ottoman Empire's last and the Turkish Republic's first period[2]. After the Surname Law was adopted in 1934 in the new Turkish Republic, he chose his surname Özarun, meaning good-natured people (Aslan-Seyhan, 2024). After he graduated from Dârüşşafaka, he worked as a translator; he was fluent in both French and English. In 1888, he pursued his career in teaching in Dârüşşafaka. He worked in the schools such as Mekteb-i Mülkiye-i Şâhâne, Dârülfünun, Mercan Îdâdîsi, Istanbul Highschool, Maliye Mektebi and Dârülmuallimîn-i Âliye. He received an honorary

[1]For the brief introduction of all of the mechanical textbooks written in the 19th century in the Ottoman Empire please see (Aslan-Seyhan, 2024).

[2]Ottoman Empire founded in the 13th c. and lasted till early 20th c. The Modern Turkish Republic was founded on 29 October 1923.

degree to teach the mechanical engineering course from Dârüşşafaka. He taught lessons in mathematics, astronomy, and mechanics until 1935. He passed away in 1940 (Gök, 2022; İhsanoğlu, 1999; İhsanoğlu et al.S, 2006; Aslan-Seyhan, 2024).

2.1. Mehmet İzzet's Works on Machines and Mechanical Sciences.

He wrote two books on machines and mechanical sciences. The first one of these books is *Mebâdî-i Fenn-i Makine* (Fundamental Machine Science), which was about machine science and was published in two volumes in the 1890s in Istanbul, Mirhan Publishing House.

The second book İzzet wrote about mechanics is Fenn-i Mihanik (Mechanical Science). It was published in 1893 by Karabet Publishing House in Istanbul. It has three main chapters on equilibrium, movement, and force.

2.1.1. Mebâdî-i Fenn-i Makine (Fundamental Machine Science)

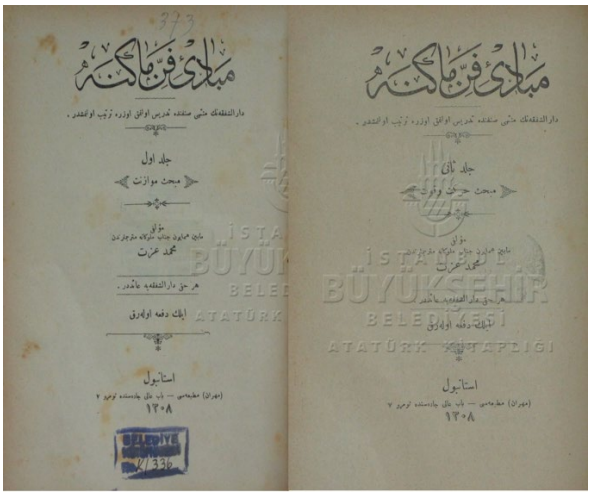

Figure 2. Cover pages of *Mebâdî-i Fenn-i Makine* vol 1&2.

This book was published in two volumes in the 1890s in Istanbul, Mirhan Publishing House (**Figure 2**). He donated all his income from the sale of this book to Dârüşşafaka (Gök, 2022). This book was prepared for educational purposes for senior students of Darüşşafaka. The book's first volume, devoted to balance in mechanics, has six chapters, including preliminary information on mechanics, forces, moments gravitation, balance, and simple machines. Volume 1 doesn't have a content table in the original manuscript[3] (Mehmet İzzet, 1890a). But after examining the book, the content table is prepared as follows (**Table 1**).

The second volume is about movement and motion. In this book, there are three main chapters about movement. After page 133, the book restarts as the 3rd book. In this part, the main subject is the force. Chapter numbering was started over, and complex devices such as steam engines, steamboat machines, and railway machines were also considered in this part (Mehmet İzzet, 1890b).

[3]The volumes of *Mebâdî-i Fenn-i Makine* exist in İBB Library Collection of Rare Artifacts, inventory number Bel_Osm_K.00336/01 (vol 1) and Bel_Osm_K.00336/02 (vol 2).

Table 1. Table of contents *Mebâdî-i Fenn-i Makine v.1.* (Mehmet İzzet, 1890a).

Titles	Paper Number
Introduction	IV
1.1. Preliminary Information	1
1.2. Domain of Forces	6
2.1. Composition of Forces	12
2.2. Analysis of Forces	32
2.3. The Relation Between the Resultant Force and Composition of Forces	39
2.4. Forces on a Fixed Axis	44
2.5. Moment	52
Exercises	65
3.1. Combination of Parallel Forces	74
3.2. Application of a Force on the Parallel Forces	83
Exercises	100
4.1. Universal Gravitation	109
4.2. General Rules for Determining the Center of Gravity	116
4.3. Determining the Center of Gravity in Simple Geometry	121
4.4. Theory and Application of The Force	145
5. Random Forces	161
5.1. Composition of Random Forces	162
5.2. Equality of Suspended Objects in Terms of Weight	166
Exercises	192
6. Simple Machines	201
6.1. Lever, Scale, Balance Romaine, Weighbridge, Inclined Plane, Fixed Pulley, Moveable Pulley, Block and Pulley, Spinning Wheel, Capstan, Helix and Screw.	203
Exercises	288

There is a table of contents (fihrist) at the beginning of volume 2. However, it is insufficient and confusing. The table of contents and the book itself do not match since Mehmet İzzet's table of contents is based on the last pages of the chapters, not the first. Moreover, there are some mistakes in his enumeration of the chapters, sections, and sub-sections. For this reason, an alternative table of contents was created in the following (**Table 2**) to provide more information about the book's content.

The first edition of this book was published in 1893 by Karabet Publishing House in Istanbul (Gök, 2022)[4]. 2nd edition of this book was an extended form of

[4]Today the manuscript exists in the Atatürk Univ. Library Seyfettin Özege Rare Artifacts Collection, inventory number 0110678.

Table 2. Table of contents *Mebâdî-i Fenn-i Makine v.2* (Mehmet İzzet, 1890b).

Titles	Paper Number
1. About Movement	1
1.1. Elementary information	3
1.2. Types of motion. (Uniform motion variable motion, average motion)	11
Exercises	26
Stationary objects	46
Exercises	58
1.3. Movement on a Curve	64
Circular Motion	67
Translational Motion	73
Exercises	74
2. Composition of Movements	78
2.1. Parallel Motion	81
2.2. Uniform Linear Motion	88
Relative Motion	93
3. Machines that Provide Movement (belts and pulleys, cylinder friction, gear wheels, Watt's paralelogram, Peaucellier rhombus, linkages of Watt's and Peaucellier crank (manivelle), Archimedes spiral, screw.)	103
The book 3. Force.	133
1.1. Dynamic. General Evaluation About Force. Various States of Force.	133
Kepler	134
Newton	137
Galileo	140
Motion Produced by a Constant Force	141
Gravity Applications	156
Motion of an Object on an Inclined Plane	157
Inertia Force	168
Centrifugal Force	171
Pendulum	179
1.2. Applied Mechanics	198
1.3. Transmission of Applied Mechanics to Machines	220
Transmission of Applied Mechanics to Simple Machines	227
1.4. Collision of Objects	233

Continued

the first one, and it was published two years later. It is a textbook written for the secondary education institution (idâdîler) that trains students for engineering schools. In his introduction, Mehmet İzzet discusses the etymology of mechanics. He mentions the Greek origins of this word and he defines this science as its main objective was making and using specific tools. He also mentioned that in modern times, this science collects the rules of the entire machinery industry (Dosay-Gökdoğan & Demir, 2018). He describes this science as "Knowledge about the force of motion for the balance and movement of objects, as well as the rules for the purpose and use of machines…" (Mehmet İzzet, 1895).

2.1.2. Fenn-i Mihanik (Mechanical Science)

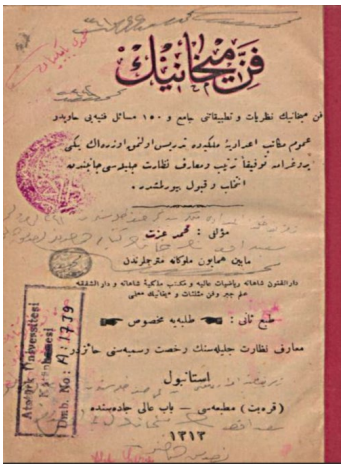

Figure 3. Cover page of *Fenn-i Mihanik.*

In his introduction, Mehmet İzzet draws our attention to the relation between geometry, mechanics, and astronomy (**Figure 3**). He says the "theories derive from geometry and are an essential part of the applications transferred from astronomy" (Mehmet İzzet, 1895). This is especially interesting since he lectured on all these subjects (Aslan-Seyhan, 2024). He also mentioned that he examined the subject by dividing it into three main parts: equilibrium, motion, and force. At the book's end there is a French-Turkish glossary (Mehmet İzzet,

1895; Gök, 2022). The book doesn't have a content table in the original manuscript, but after examining the book from beginning to end, the table of contents is prepared as follows (Table 3).

Table 3. Table of contents *Fenn-i Mihanik* (Mehmet İzzet, 1895).

Titles	Paper Number
Introduction	1
1. Equilibrium	15
1.1. Composition and Analysis of Forces	15
1.1.1. Composition of Forces	15
1.1.2. Relation Between the Resultant Force and Component Force	32
1.1.3. Analysis of Forces	36
1.1.4. Moment of Absolute Force Accordance to a Point	44
1.2. Parallel Forces	57
1.2.1. Composition of Parallel Forces	57
1.2.2. Analysis of Parallel Forces	65
1.2.3. Moment of Parallel Forces	68
1.3. Center of Gravity	80
1.3.1 General Description	80
1.3.2. General Rule for Determining the Center of Gravity	87
1.3.3. Determining the Center of Gravity of Geometric Objects	91
1.4. General Composition of the Forces	103
1.4.1. Composition of Random Forces	103
1.4.2. General Conditions for the Equilibrium of Solids	107
1.5. Simple Machines	127
1.5.1. General Description about Machines	127
1.5.2. Lever	129
1.5.3. Weighing Instruments	135
1.5.4. Pulleys and Spinning Wheels	151
1.5.5. Inclined Plane	165
2. Science of Movement	184
2.1. Types of Movements	184
2.1.1. First Information	184
2.1.2. Uniform motion	192
2.1.3. Non-uniform Motion	197
2.1.4. Uniform Variable Motion	203
2.1.5. Inertia	210

Continued

2.1.6. Rotational Movement	220
2.2. Compound Movement	235
2.2.1. Resultant of the uniform motion	238
2.2.2. Resultant of the non-uniform motion	243
3. Science of Force	255
3.1.1. Fundamental Laws	255
3.1.2. The Proportion of Forces to the Amount of Motion	279
3.1.3. Centrifugal Force	282
3.2.1. Applied Mechanics	301
3.2.2. Energy, Force Vive	311
3.2.3. Transfer of Applied Mechanics to Machines	325
3.2.4. Transfer of Applied Mechanics to Simple Machines	335
3.3. Resistance (Friction and Its Varieties, Laws, Applications)	344
3.3.1. Friction and Rubbing	344
3.3.2. Durability of Vehicles and Collision of Objects	363
French Ottoman Glossary	371-374

3. Conclusion

Throughout his life, Mehmet İzzet translated and compiled many books and textbooks in literature, natural sciences, physics, astronomy, mechanics, mathematics, and many more. This paper presented his books on mechanics, which serve the history of Turkish mechanical education with great care and made them available for students.

His first book mentioned in this paper, *Mebâdî-i Fenn-i Makine*, has two volumes and is prepared for the senior students of Darüşşafaka. The phrase 'Fenn-i Makine' was used to state machine science in Ottomans in the 19th century. This century's books preferring this name contain information on the context of mechanics and some additional parts about machinery focusing on movement. Mehmet İzzet's books can be considered an example of such books. In his first volume, after giving preliminary information about forces, he mentions the composition and the analysis of the forces. He also mentions the momentum, gravitation, and simple machines in this volume.

In the second volume of the first book, he supplies elementary information on movement and motion, including relative motion. This volume includes Watt's parallelogram, Peaucellier rhombus, and Archimedes spiral as machines providing movement. In the last part of this volume, a new chapter named as the "3rd book" is dedicated to dynamics and force. In this part, the author mentions the laws of Kepler, Newton, and Galileo and explains the applications of gravity and the transmission of applied mechanics to machines. Clockwork machines, steam

engines, boilers, steamboat machines, and railway machines were considered, along with various examples.

The second book, *Fenn-i Mihanik*, is a voluminous book of 374 pages. Fenn-i mihanik means "mechanical sciences". Before the 19th century, "Cerr-i Eskal" was used to state the mechanics or mechanical sciences. In Arabic, "cerr" means pulling and dragging, while "eskal" means heavy loads (Akbaş, 2008; Aslan-Seyhan, 2024; Devellioğlu, 1995). But after the 19th century, this Arabic expression was replaced by fenn-i mihanik.

This book contains three main chapters: equilibrium, movement, and force. By the end of this book, there is a four-page French Ottoman Glossary. This part is essential for historians of mechanics to understand the Ottoman terminology on mechanical science.

Mehmet İzzet's books are comprehensive and give us an insight into the content of mechanical education in the Ottoman Military Engineering Academies in the 19th century. His definitions for the fundamental subjects include introductory information and consistent mainstream definitions based on Newtonian mechanics. For instance, to define force, he used the classical definition, which includes movement. For movement, first, mobility is explained, and then the concept itself is explained with displacement. The concept of equilibrium is explained by the resultant force and moment, including the center of gravity in the subject via solid bodies and vectors (Halliday, Resnick, & Walker, 2005). All of his books, like their contemporaries written in the 19th century Ottoman Empire, contain fundamental information on physics and mechanics. Understanding mechanics education in this period is important because of its historical value and because it might help us understand the reasons for the failed attempt at industrialization of Ottomans.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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