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# Course Syllabus

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|---|---|---|
| 1 | **Course title** | ***Classical Mechanics 1*** |
| 2 | **Course number** | ***0302351*** |
| 3 | **Credit hours** | ***3*** |
| | **Contact hours (theory, practical)** | ***Three 60 min. lectures per week, extended to 14 weeks. Zero practical hours.*** |
| 4 | **Prerequisites/corequisites** | ***Mathematical Physics 1 (0302281)*** |
| 5 | **Program title** | ***Physics*** |
| 6 | **Program code** | ***0302*** |
| 7 | **Awarding institution** | ***The University of Jordan*** |
| 8 | **School** | ***School of Science*** |
| 9 | **Department** | ***Physics*** |
| 10 | **Course level** | ***Third Year*** |
| 11 | **Year of study and semester(s)** | ***Third Year, First or second semester*** |
| 12 | **Other department(s) involved in teaching the course** | ***NONE*** |
| 13 | **Main teaching language** | ***English*** |
| 14 | **Delivery method** | ☒Face to face learning ☐Blended ☐Fully online |
| 15 | **Online platforms(s)** | ☐Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others…… |
| 16 | **Issuing/Revision Date** | ***June, 26, 2024*** |

**17 Course Coordinator:**

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| **Name:** ***Moneeb T. M. Shatnawi*** |
| **Contact hours:** ***10:30 – 11:30 / Sundays, Tuesdays, and Thursdays*** |
| **Office number:** ***Room 200 / Physics Building*** |
| **Phone number:** ***962 - 6 – 5355000 Ext. 22064*** |
| **Email: moneeb.shatnawi@ju.edu.jo** |

**18 Other instructors: NONE**

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| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |
| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |

**19 Course Description:**

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| As stated in the approved study plan: |
| *This course forms the first part of classical mechanics. It is designated for undergraduate students majoring in physics. It is expected that the students have taken a year of calculus-based general physics as well as a year of differential and integral calculus.* |
| *As the department of physics requires the students to take two courses in classical mechanics as compulsory, the fundamental concepts in classical mechanics have been divided between these* |

*two courses. This course forms the first part of the series, and focuses on basic classical mechanics concepts.*

*An overview of the topics that will be covered in this course include a quick review of general physics 1 (Mechanics), fundamental concepts in vectors, Newtonian Mechanics applied to rectilinear motion of a particle, Oscillations, general motion of a particle in three dimensions, gravitation, central forces and planetary motion.*

*The more advanced topics in classical mechanics such as motion in non-inertial reference frames, Lagrangian mechanics, Hamiltonian mechanics, rotation of a rigid body about a fixed axis, are left to the second course in classical mechanics (PHY 0302352).*

**20 Course aims and outcomes:**

**A- Aims:**

*The most important aims and objectives of this course are summarized below:*

*- To provide students with a brief account about vector calculations and vector calculus.*

*- To build a broad knowledge about classical mechanics concepts. These include the concepts of force, matter, motion and the relationships among them.*

*- To understand basic dynamics concepts, such as force, momentum, work , work-energy principle, impulse-momentum principle and energy, and to be able to apply them.*

*- To develop deep understanding of Newton's laws of motion and to utilize this knowledge in solving different mechanics problems.*

*- To analyze general motion of a particle subjected to different types of retarding forces.*

*- To develop excellent account about oscillatory motion, in particular students will study simple harmonic motion with and without the presence of damping forces as well as the driven oscillations and resonance.*

*- To develop deep understanding about gravitational field, gravitational potential and gravitational potential energy.*

*- To understand the concept of central forces and realize the reduction of a two-body problem to a one-body problem in a central-force field.*

*- To analyze planetary motion mathematically and describe orbital motion of planets.*

- *To realize the concepts and consequences of Kepler's laws and be able to derive them.*

- *To find the central force law responsible for the motion of a particle in a given orbit.*

## Course Student's learning outcomes (SLO):

*Upon successful completion of this course, I expect that:*

*SLO #1: Students should gain a brief account about vector calculations and vector calculus.*

*SLO #2: Students should build a broad knowledge about classical mechanics concepts. These include the concepts of force, matter, motion and the relationships among them.*

*SLO #3: Students should understand basic dynamics concepts, such as force, momentum, work , work-energy principle, impulse-momentum principle and energy, and to be able to apply them in solving mechanics problems.*

*SLO #4: Students should develop deep understanding of Newton's laws of motion and to utilize this knowledge in solving different mechanics problems.*

*SLO #5: Students should be able to analyze general motion of a particle subjected to different types of retarding forces.*

*SLO #6: Students should develop excellent account about oscillatory motion, in particular students should describe and analyze simple harmonic motion with and without the presence of damping forces as well as be able to deal with the driven oscillations and know the concept of resonance.*

*SLO #7: Students should develop deep understanding about gravitational field, gravitational potential and gravitational potential energy.*

*SLO #8: Students should understand the concept of central forces and realize the reduction of a two-body problem to a one-body problem in a central-force field.*

*SLO #9: Students should be able to analyze planetary motion mathematically and describe orbital motion of planets.*

*SLO #10: Students should realize the concepts and consequences of Kepler's laws and be able to derive them.*

*SLO #11: Students should be able to find the central force law responsible for the motion of a particle in a given orbit.*

**B- Students Learning Outcomes (SLOs):**

For purposes of mapping the course SLOs to the physics program SLOs, at the successful completion of the physics program, graduates are expected to be able to:

**SLO (1)** Master professionally a broad set of knowledge concerning the fundamentals in the basic areas of physics: Quantum Mechanics, Classical Mechanics, Electrostatics and Magnetism, Thermal Physics, Optics, Theory of Special Relativity, Mathematical Physics, Electronics.

**SLO (2)** Apply knowledge of mathematics and fundamental concepts in the basic areas of physics to identify and solve physics related problems.

**SLO (3)** Utilize computers and available software in both data collections and data analysis.

**SLO (4)** Utilize standard laboratory equipment, modern instrumentation, and classical techniques to design and conduct experiments as well as to analyze and interpret data.

**SLO (5)** Develop a recognition of the need and ability to engage in life-long learning.

**SLO (6)** Demonstrate ability to use techniques, skills, and modern scientific tools necessary for professional practice.

**SLO (7)** Communicate clearly and effectively in both written and oral forms.

**SLO (8)** Apply proficiently team-work skills and employ team-based learning strategies.

**SLO (9)** Apply professional and ethical responsibility to society.

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**Upon successful completion of this course, students will be able to:**

| Program SLOs / Course SLOs | SLO (1) | SLO (2) | SLO (3) | SLO (4) | SLO (5) | SLO (6) | SLO (7) | SLO (8) | SLO (9) |
|---|---|---|---|---|---|---|---|---|---|
| 1. *SLO #1: Students should gain a brief account about vector calculations and vector calculus.* | ✓ | ✓ | | | ✓ | | | | |
| 2. *SLO #2: Students should build a broad knowledge about classical mechanics concepts. These include the concepts of force, matter, motion and the relationships among them.* | ✓ | ✓ | | | ✓ | | | | |
| 3. *SLO #3: Students should understand basic dynamics concepts, such as force, momentum, work , work-energy principle, impulse-momentum principle and energy, and to be able to apply them in solving mechanics problems.* | ✓ | ✓ | | | ✓ | | | | |
| 4. *SLO #4: Students should develop deep understanding of Newton's laws of motion and to utilize this knowledge in solving different mechanics problems.* | ✓ | ✓ | | | ✓ | | | | |
| 5. *SLO #5: Students should be able to analyze general motion of a particle subjected to different types of retarding forces.* | ✓ | ✓ | | | ✓ | | | | |
| 6. *SLO #6: Students should develop excellent account about oscillatory motion, in particular students should describe and analyze simple harmonic motion with and without the presence of damping forces as well as be able to deal with the driven oscillations and know the concept of resonance.* | ✓ | ✓ | | | ✓ | | | | |
| 7. *SLO #7: Students should develop deep understanding about gravitational field, gravitational potential and gravitational potential energy.* | ✓ | ✓ | | | ✓ | | | | |

**Continue: Upon successful completion of this course, students will be able to:**

| Program SLOs / Course SLOs | SLO (1) | SLO (2) | SLO (3) | SLO (4) | SLO (5) | SLO (6) | SLO (7) | SLO (8) | SLO (9) |
|---|---|---|---|---|---|---|---|---|---|
| 8. *SLO #8: Students should understand the concept of central forces and realize the reduction of a two-body problem to a one-body problem in a central-force field.* | ✓ | ✓ | | | ✓ | | | | |
| 9. *SLO #9: Students should be able to analyze planetary motion mathematically and describe orbital motion of planets.* | ✓ | ✓ | | | ✓ | | | | |
| 10. *SLO #10: Students should realize the concepts and consequences of Kepler's laws and be able to derive them.* | ✓ | ✓ | | | ✓ | | | | |
| 11. *SLO #11: Students should be able to find the central force law responsible for the motion of a particle in a given orbit.* | ✓ | ✓ | | | ✓ | | | | |
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## 21. Topic Outline and Schedule:

| Week | Lecture | *Topic* | Intended Learning Outcome | Learning Methods (Face to Face/Blended/ Fully Online) | Platform | Synchronous / Asynchronous Lecturing | Evaluation Methods | Resources |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.1 | *Review / Basic Concepts 1* | | | | | | |
| | 1.2 | *Review / Basic Concepts 2* | | | | | | |
| | 1.3 | *Review / Basic Concepts 3* | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| 2 | 2.1 | *Chapter 1/ Vectors 1* | | | | | | |
| | 2.2 | *Chapter 1/ Vectors 2* | | | | | | |
| | 2.3 | *Chapter 1/ Vectors 3* | | | | | | |
| **Week** | **Lecture** | ***Topic*** | **Intended Learning Outcome** | **Learning Methods (Face to Face/Blended/ Fully Online)** | **Platform** | **Synchronous / Asynchronous Lecturing** | **Evaluation Methods** | **Resources** |
| 3 | 3.1 | *Chapter 1/ Rotation of coordinate systems* | | | | | | |
| | 3.2 | *Chapter 1/ Rotation of coordinate systems* | | | | | | |
| | 3.3 | *Chapter 1 / Polar coordinates* | | | | | | |
| 4 | 4.1 | *Chapter 2/ Newton's Laws 1* | | | | | | |
| | 4.2 | *Chapter 2/ Newton's Laws 2* | | | | | | |
| | 4.3 | *Chapter 2/ Newton's Laws 3* | | | | | | |
| 5 | 5.1 | *Chapter 2/ Position dependent forces 1* | | | | | | |
| | 5.2 | *Chapter 2/ Position dependent forces 2* | | | | | | |
| | 5.3 | *Chapter 2 / Velocity dependent forces 1* | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| 6 | 6.1 | *Chapter 2 / Velocity dependent forces 2* | | | | | | |
| | 6.2 | *Chapter 2 / Review Examples* | | | | | | |
| | 6.3 | *Chapter 2 / Review Examples* | | | | | | |
| 7 | 7.1 | *Chapter 3 / Simple Harmonic Motion / part 1* | | | | | | |
| | 7.2 | *Chapter 3 / Simple Harmonic Motion / part 2* | | | | | | |
| | 7.3 | *Chapter 3 / Simple Harmonic Motion / Energy considerations* | | | | | | |
| 8 | 8.1 | *Chapter 3 / Damped Harmonic Motion* | | | | | | |
| | 8.2 | *Chapter 3 / Damped Harmonic Motion/ Energy considerations* | | | | | | |
| | 8.3 | *Chapter 3 / Forced Harmonic Motion* | | | | | | |
| 9 | 9.1 | *Chapter 3 / Forced Harmonic Motion / Resonance* | | | | | | |
| | 9.2 | *Chapter 3 / Forced Harmonic Motion / Resonance / Energy* | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| | | *considerations* | | | | | | |
| | 9.3 | *Chapter 3 / Electrical Oscillations / RLC circuit 1* | | | | | | |
| 10 | 10.1 | *Chapter 3 / Electrical Oscillations / RLC circuit 2* | | | | | | |
| | 10.2 | *Chapter 4 / General motion of a particle in 3 dim.* | | | | | | |
| | 10.3 | *Chapter 4 / General motion of a particle in 3 dim. / Projectile motion* | | | | | | |
| 11 | 11.1 | *Chapter 4 / General motion of a particle in 3 dim. / Motion in EM filed* | | | | | | |
| | 11.2 | *General Gravitation 1* | | | | | | |
| | 11.3 | *General Gravitation 2* | | | | | | |
| 12 | 12.1 | *General Gravitation 3* | | | | | | |
| | 12.2 | *General Gravitation 4 / Examples* | | | | | | |
| | 12.3 | *Chapter 6 / Central Force Motion / Reduction to one-body problem* | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| | 13.1 | *Chapter 6 / Central Force Motion / Constants of the motion / The energy equation* | | | | | | |
| 13 | 13.2 | *Chapter 6 / Central Force Motion / Derivation of the force-law equation* | | | | | | |
| | 13.3 | *Chapter 6 / Central Force Motion / Centrifugal energy and effective potential* | | | | | | |
| | 14.1 | *Chapter 6 / Central Force Motion / Planetary Motion* | | | | | | |
| 14 | 14.2 | *Chapter 6 / Central Force Motion / Kepler's Laws* | | | | | | |
| | 14.3 | *General Review* | | | | | | |
| | 15.1 | *Final Exams week* | | | | | | |
| 15 | 15.2 | | | | | | | |
| | 15.3 | | | | | | | |

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**22 Evaluation Methods:**

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

| Evaluation Activity | Mark | Topic(s) | SLOs | Period (Week) | Platform |
|---|---|---|---|---|---|
| Review Exam | ***10*** | ***Introductory Physics 1 (Newtonian Mechanics)*** | | ***3*** | ***In Class*** |
| First Exam | ***15*** | ***Linear and general motion of a particle*** | | ***5*** | ***In Class*** |
| Second Exam | ***20*** | ***Oscillations and General motion of a particle*** | | ***10*** | ***In Class*** |
| Homework assignments | ***5*** | ***All course contents*** | | ***Through Semester*** | ***Solved at home, handed in class.*** |
| Final Exam | ***50*** | ***All course contents*** | | ***15*** | ***In Class*** |
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**23 Course Requirements**

**(e.g: students should have a computer, internet connection, webcam, account on a specific software / platform…etc):**

***Students should have access to Teams program, as well as to the university e-learning website.***

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**24 Course Policies:**

**A- Attendance policies:**

*Attendance is obligatory according to the University rules.*

**B- Absences from exams and submitting assignments on time:**

*Absences from exams require a legal excuse accepted by university regulations. All assignments should be handed on due date.*

**C- Health and safety procedures:**

*No health or safety concerns are related to this course.*

**D- Honesty policy regarding cheating, plagiarism, misbehavior:**

*In case of cheating or any type of misbehavior, university regulations are applied.*

**E- Grading policy:**

*All exams are graded by the course instructor based on standard key solutions with predetermined grade for each question.*

**F- Available university services that support achievement in the course:**

*University E-learning platform, multiple university computer labs as well as the university library.*

**25 References:**

**A- Required book(s), assigned reading and audio-visuals:**

*"Analytical Mechanics" by Grant R. Fowles and George L. Cassiday, 7th Edition, 2005, Thomson/Brooks-cole.*

**B- Recommended books, materials, and media:**


1. *Marion, J. B., and Thornton, S. T., Classical Dynamics, 5th ed., Brooks/Cole-Thomson Learning, Belmont, CA, 2004.*
2. *Smith, P., and Smith, R. C., Mechanics, John Wiley & Sons, New York, 1990.*
3. *Rossberg, K., A First Course in Analytical Mechanics, Wiley, New York, 1983.*
4. *Barger, V., and Olsson, M., Classical Mechanics, McGraw-Hill, New York, 1973.*
5. *Symon, K., Mechanics, 3rd ed., Addison-Wesley, Reading, Mass., 1971.*
6. *Hauser, W, Introduction to the Principles of Mechanics, Addison-Wesley, Reading, Mass., 1965.*
7. *"Fundamentals of Physics" by D. Halliday & R. Resnick, (Any Edition).*
8. *"Physics for Scientists and Engineers" by R. Serway, (Any Edition).*

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**26 Additional information:**

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| *In order to enhance student's collaboration and involvement in group work and communication, a set of specific topics may be assigned to a group of students who can read and study well and make a presentation in front of the class about that topic.* |

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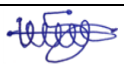
| Name of Course Coordinator: ***Moneeb T. M. Shatnawi*** Signature:  Date: ***26/6/2024*** |
| Head of Curriculum Committee/Department: ---------- Signature: ---------- |
| Head of Department: ---------- Signature: ---------- |
| Head of Curriculum Committee/Faculty: ---------- Signature: ---------- |
| Dean: ---------- Signature: ---------- |