



## Course Specifications

|                      |                     |
|----------------------|---------------------|
| <b>Course Title:</b> | Classical Mechanics |
| <b>Course Code:</b>  | 251PHYS             |
| <b>Program:</b>      | Physics             |
| <b>Department:</b>   | Physics             |
| <b>College:</b>      | Science             |
| <b>Institution:</b>  | Jazan University    |

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## A. Course Identification

|   |  |                                   |  |
|---|--|-----------------------------------|--|
| <b>1. Credit hours: 3</b>   |  |                                   |  |
| <b>2. Course type</b>   |  |                                   |  |
| a.  | University <input type="checkbox"/>          | College <input type="checkbox"/>  | Department <input checked="" type="checkbox"/> |
| b.  | Required <input checked="" type="checkbox"/> | Elective <input type="checkbox"/> | Others <input type="checkbox"/>                |
| <b>3. Level/year at which this course is offered: Level 3/ Year 2</b> |  |                                   |  |
| <b>4. Pre-requisites for this course (if any): Nil</b>                |  |                                   |  |
| <b>5. Co-requisites for this course (if any): Nil</b>                 |  |                                   |  |

### 6. Mode of Instruction (mark all that apply)

| No | Mode of Instruction   | Contact Hours | Percentage |
|----|-----------------------|---------------|------------|
| 1  | Traditional classroom | 40            | 90%        |
| 2  | Blended               | 5             | 10%        |
| 3  | E-learning            |               |            |
| 4  | Distance learning     |               |            |
| 5  | Other                 |               |            |

### 7. Contact Hours (based on academic semester)

| No | Activity          | Contact Hours |
|----|-------------------|---------------|
| 1  | Lecture           | 40            |
| 2  | Laboratory/Studio | --            |
| 3  | Tutorial          | 5             |
| 4  | Others (specify)  |               |
|    | <b>Total</b>      | <b>45</b>     |

## B. Course Objectives and Learning Outcomes

### 1. Course Description

The course is designed to provide students with 1. The fundamental concepts of vectors and its basics operations 2. Newton laws of motion. 3. Application of Newton's laws in one and two dimension and in rectilinear motion 4. The concepts of work and energy and their applications in physical problems 5. The essential of the rotational motion and the rotational parameters and their analogy in linear motion 6. the physics of planetary motion and Kepler's laws.

## 2. Course Main Objective

**This course is designed to provide students with:**

The course is designed to provide students with

- The Fundamental concept of vectors and basics vectors operations
- The derivation of Newton laws of motions. 1D and 2D motion and rectilinear motion
- Understanding the concept of work and energy and their applications
- A description for the rotational motion and analogy of the rotational parameters with liner one
- Understanding for the physics of planetary motion.

## 3. Course Learning Outcomes

| CLOs     |   | Aligned PLOs  |
|----------|---|---------------|
| <b>1</b> | <b>Knowledge and Understanding</b>  |               |
| 1.1      | <b>Define</b> the scalar and vectors quantities, the position, velocity and acceleration in different coordinates, the linear and rotational motion parameters                  | <b>PLO1.1</b> |
| 1.2      | <b>State</b> the Newton's law of motion and Kepler's laws of planetary motion   | <b>PLO1.1</b> |
| 1.3      | <b>Discuss</b> the concept of energy and momentum conservation in linear and rotational motion  | <b>PLO1.2</b> |
| <b>2</b> | <b>Skills :</b>   |               |
| 2.1      | <b>Derive</b> Newton's laws of motion and laws of planetary motion  | <b>PLO2.2</b> |
| 2.2      | <b>Solve</b> physical problems related to the motion in 1D, 2D, rectilinear, and rotational motion, in addition for the particle motion under gravitational and central forces. | <b>PLO2.1</b> |
| 2.3      | <b>Develop</b> communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities                                | <b>PLO2.4</b> |
| <b>3</b> | <b>Values:</b>  |               |
| 3.1      | <b>Show</b> effective collaboration and bear individual responsibility during group work and/or assignments   | <b>PLO3.1</b> |

## C. Course Content

| No | List of Topics  | Contact Hours |
|----|---|---------------|
| 1  | - <b>Vectors:</b> Equality of vectors, vector addition, multiplication by a scalar, vector subtraction, commutative law, associative law, distributive law, magnitude of a vector, Scalar product, cross product, physical examples of products, triple product, derivative of a vector, position vector, velocity and acceleration   | 9             |
| 2  | - <b>Newtonian Mechanics:</b> Newton laws of motion: first, second, and third law. Linear momentum, motion of a particle, rectilinear motion: uniform acceleration under a constant force. Derivation of Newton equations of motion, motion on inclined surface, forces that depend on position: the concepts of kinetic and potential energy. Motion of a body with variable mass: rocket motion | 9             |
| 3  | - <b>Energy:</b> Kinetic and potential energy, dynamic systems and the laws of conservation of energy.  | 6             |
| 4  | - <b>Circular and Rotational Motion:</b> Angular displacement, angular velocity, angular acceleration, rotational kinematics: Rotational motion with constant   | 9             |

|              |  |           |
|--------------|--|-----------|
|              | angular acceleration, rotational acceleration, rotational energy, moment of inertia, angular momentum and torque.  |           |
| 5            | - <b>Newton Gravitation:</b> Newton's law of gravitation, Kepler's Laws: Newton's law of universal gravitation, Kepler's Laws of Planetary Motion: Kepler's First Law: The Law of Ellipses, Kepler's Second Law: Equal Areas and Conservation of Angular Momentum, Kepler's Third Law: The Harmonic Law and their mathematical derivations | 9         |
| 6            | <b>Review</b>  | 3         |
| <b>Total</b> |  | <b>45</b> |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes   | Teaching Strategies   | Assessment Methods   |
|------|--|---|--|
| 1.0  | <b>Knowledge and Understanding</b>   |   |  |
| 1.1  | <b>Define</b> the scalar and vectors quantities, the position, velocity and acceleration in different coordinates, the linear and rotational motion parameters | Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion | <b>Direct</b> (formative and summative): In class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey |
| 1.2  | <b>State</b> the Newton's law of motion and Kepler's laws of planetary motion  | Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion | <b>Direct</b> (formative and summative): In class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey |
| 1.3  | <b>Discuss</b> the concept of energy and momentum conservation in linear and rotational motion   | Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion | <b>Direct</b> (formative and summative): In class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey |
| 2.0  | <b>Skills :</b>  |   |  |
| 2.1  | <b>Derive</b> Newton's laws of motion and laws of planetary motion   | Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion | <b>Direct</b> (formative and summative): In class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey |
| 2.2  | <b>Solve</b> physical problems related to the motion in 1D, 2D, rectilinear, and   | Lectures, blackboard and visualization, group and   | <b>Direct</b> (formative and summative): In  |

| Code       | Course Learning Outcomes   | Teaching Strategies   | Assessment Methods   |
|------------|--|---|--|
|            | rotational motion, in addition for the particle motion under gravitational and central forces.   | interactive guided discussion, Interactive discussion   | class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey   |
| 2.3        | <b>Develop</b> communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities | Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning | <b>Direct</b> (formative and summative): In class interactive questioning, quizzes, written exams<br><b>Indirect:</b> student survey |
| <b>3.0</b> |  |   |  |
| 3.1        | <b>Show</b> effective collaboration and bear individual responsibility during group work and/or assignments                                      | Interactive and Group discussion, expository and discovery teaching   | <b>Direct</b> (formative and summative): interactive questioning- group assignment<br><b>Indirect:</b> student survey                |

## 2. Assessment Tasks for Students

| # | Assessment task*  | Week Due | Percentage of Total Assessment Score |
|---|---|----------|--------------------------------------|
| 1 | Homework assignment- Contribution in interactive discussion- Group work or Project                  | 3        | 3 (3%)                               |
| 2 | Lecture Quiz 1  | 4        | 5 (5%)                               |
| 3 | First Mid-term exam   | 6        | 15 (15%)                             |
| 4 | Homework assignment- Contribution in interactive discussion- Group work or Project                  | 10       | 3 (3%)                               |
| 5 | Lecture Quiz 2  | 11       | (5%) 5                               |
| 6 | Second mid-term exam  | 12       | 15 (15%)                             |
| 7 | Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion | 11       | 4 (4%)                               |
| 9 | Final Exam  | 16       | 50 (50%)                             |

\*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

## F. Learning Resources and Facilities

## 1. Learning Resources

|                                       |  |
|---------------------------------------|--|
| <b>Required Textbooks</b>             | Analytical Mechanics; G. R. Fowls and G. Cassiday – 7 <sup>th</sup> edition, Brooks, Cole, publishing, 2004.   |
| <b>Essential References Materials</b> | -Classical Mechanics; V. Barges and M. Olsson, McGraw Hill, 1995.<br>- Classical Mechanics; T. L. Chow, John Wiley and Son Ltd, 1995.  |
| <b>Electronic Materials</b>           | <a href="http://ocw.mit.edu/courses/physics/">http://ocw.mit.edu/courses/physics/</a><br><a href="http://laserworld.com">http://laserworld.com</a><br><a href="http://www.physics.org/explore.asp">http://www.physics.org/explore.asp</a><br><a href="http://www.wikipedia.org/">http://www.wikipedia.org/</a> |
| <b>Other Learning Materials</b>       |  |

## 2. Facilities Required

| Item   | Resources   |
|--|---|
| <b>Accommodation</b><br>(Classrooms, laboratories, demonstration rooms/labs, etc.)   | Class room- if possible room for interactive discussion (round table) |
| <b>Technology Resources</b><br>(AV, data show, Smart Board, software, etc.)  | Data show- smart board  |
| <b>Other Resources</b><br>(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | none  |

## G. Course Quality Evaluation

| Evaluation Areas/Issues                           | Evaluators                             | Evaluation Methods                       |
|---|--|--|
| Effectiveness of teaching                         | Students, Peer and program leader      | Indirect (CES)- Indirect peer evaluation |
| Assessment  | Students, Program assessment committee | Direct/ Indirect                         |
| Extent of achievement of course learning outcomes | Instructor                             | Direct/Indirect                          |
| Quality of learning resources                     | Students, Faculty members              | Indirect                                 |
| Effectiveness of teaching                         | Students, Peer and program leader      | Indirect (CES)- Indirect peer evaluation |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

|                            |                                      |
|----------------------------|--------------------------------------|
| <b>Council / Committee</b> | <b>Council of Physics Department</b> |
| <b>Reference No.</b>       | 8                                    |
| <b>Date</b>                | 16/4/1442                            |