

**MALAWI UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**MALAWI INSTITUTE OF TECHNOLOGY**

**APPLIED STUDIES DEPARTMENT**

1. **Programme(s):** BESC/BMEC/BPRE
2. **Subject:**  Physics
3. **Year/Level of study:** 2/1
4. **Module Title:** Advance Mechanics & Kinetic Theory of Gases
5. **Module code:** PHYS-2103
6. **Course Duration:** 13 weeks
7. **Presented to:** Senate
8. **Presented by:** Malawi Institute of Technology
9. **Lectures (hrs/wk):** 3
10. **Tutorial (hrs/wk):** 1
11. **Laboratory (hrs/wk):** 2
12. **Students’ independent learning (hrs/wk):** 5
13. **Total course Credits:**
14. **Pre-requisites:** PHYS-1101, CHEM-1202 & MATH-1202
15. **Co-requisites:** MATH-2103(Calculus II)
16. **Delivery Methods:** 16.1 Mode of Delivery (Face to face or online)

16.2: Teaching methods: Lecturing, tutoring, laboratory practical.

**17. Assessment Methods** Mid-semester exams, tests, Assignments, Quizzes and End of semester Examination.

**18. Assessment Criteria/Weighting** Coursework: 50%

Assignment: 15%

Mid semester test: 20%

Test 2: 15%

End of semester examination: 50%

1. **Module Aim**

The module aim is to provide students with a foundation in Applied Mechanics and Kinetic Theory of Gases, which is essential for most Bachelor of science Programmes.

1. **Intended Learning Outcomes**

Upon completion of this module students should be able to:

* 1. Use scientific laws, principles, theories, and relations in solving problems in advanced mechanics and kinetic theory of gases.
  2. Evaluate scientific data from observations and experiments.
  3. Demonstrate the use of Calculus in solving advanced problems in Mechanics.
  4. Explain the link between the kinetic theory of gases to the macroscopic properties of the gases.

1. **Module Content**

**Mechanics (Using Calculus)**

1. Dynamics: Kinematics; Instantaneous and average velocity and acceleration.
2. Kinematics of rigid a body: rotational kinematics, Uniform Circular Motion, angular velocity and acceleration.
3. Angular momentum; Moment of inertia, Conservation of angular momentum.

**Classical Physics**

1. Equilibrium and elasticity; Rigid Body in Small oscillations and stability.
2. Kepler’s laws and planetary motions, Satellite motion, Coriolis theorem, Gravitational field.
3. Euler-Lagrange equations, Euler's theorem, Euler's equation of motion Lagrange theory, Hamilton's Principle of least action.

**Kinetic Theory:**

1. **Molecular Model of an Ideal Gas**: Assumptions of Kinetic Theory. Derivation of ideal gas equation from kinetic theory. Molecular interpretation of Temperature.
2. **Molar Specific Heat of an Ideal gas**: First law of thermodynamics, ideal gases under various conditions: isothermal, isobaric, isovolumetric/isochoric, adiabatic. molar specific heat at constant volume, molar specific heat at constant pressure.
3. **Adiabatic Processes for an Ideal gas**:
4. **Equipartition of Energy:**
5. **Distribution of Molecular Speeds:** Boltzmann distribution law, Maxwell-Boltzmann speed distribution function,
6. **Prescribed texts**

Beer, F. P., et al (2013). Vector Mechanics for engineers: Statics and Dynamics (10th ed). New York: McGraw-Hill Companies.

Halliday, D, Resnick, R. and Walker, J. (2005). *Fundamentals of Physics, (7th ed)*. New York: John Wiley

Serway RA., Jewett, J. W. (2010). *Physics for Scientists and Engineers with modern physics,* (8th ed). Canada: Brooks/Cole, Cengange Learning.

Taylor, J. R. (2005). Classical Mechanics. University Science Books: USA

1. **Recommended texts**

Ginsberg, J. (2008). *Engineering Dynamics*. New York: Cambridge University Press.

Gross, G. Hauger, W. Shroder, J. Wall, W. A. and Govindjee, S. (2011). *Engineering Mechanics 3: Dynamics*. Heidelberg: Springer-Verlag.

Muncaster R. (1993). *Advanced Level Physics* (4th ed). UK: Nelson Thornes.

M. Nelkon & P. Parker (1970). *Advanced Level Physics*. London: Heinemann Educational Books.

1. **Approval Date:** October, 2019.