SP015 Rancangan Instruksional Harian

Lectures

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
<tr><td colspan="2">CODE / COURSE</td><td colspan="4">SP015</td></tr>
<tr><td colspan="2">WEEK</td><td colspan="4">1</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 1: PHYSICAL QUANTITIES AND MEASUREMENTS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Lecture</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO1: Describe basic concepts of mechanics, wave, matters, heat and thermodynamics</td></tr>
<tr><td colspan="2">SLT</td><td>F2F (hour):</td><td>1</td><td>NF2F (hour):</td><td>1</td></tr>
<tr><td>DAY
DATE
TIME
VENUE</td><td>CLASS</td><td>LEARNING OUTCOME</td><td>T&L STRATEGIES & TOOLS</td><td>REFLECTION</td><td>REMARKS</td></tr>
<tr>
<td>Monday
17/07/2023
9am-10am
BT1</td>
<td>K1</td>
<td>1.1a Define dimension.
1.2a Define scalar and vector quantities.
1.3a State the significant figures of a given number.
1.3e State the sources of uncertainty in the results of an experiment.</td>
<td>Discussion
Thought Experiments</td>
<td>
<table>
<tr><th>ITEM
*Appendix</th><th>SCORE</th></tr>
<tr><td>i</td><td>3</td></tr>
<tr><td>ii</td><td>4</td></tr>
<tr><td>iii</td><td>4</td></tr>
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<td>All objectives achieved. Students are able to understand the materials of the topic.</td>
</tr>
</table>

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
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Date: 13/07/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 2: KINEMATICS OF MOTIONS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Lecture</td></tr>
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<tr><td>Monday
24/07/2023
9am-10am
BT1</td><td>K1</td><td>2.1a Define instantaneous velocity, average velocity, uniform velocity, instantaneous acceleration, average acceleration and uniform acceleration.
2.1b Interpret the physical meaning of displacement-time, velocity-time and acceleration-time graphs. Refer Equation 1.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
*Appendix</th><th>SCORE</th></tr><tr><td>i</td><td>4</td></tr><tr><td>ii</td><td>4</td></tr><tr><td>iii</td><td>3</td></tr><tr><td>iv</td><td>3</td></tr><tr><td>v</td><td>3</td></tr></table></td><td>All objectives achieved. Students are able to understand the materials of the topic.</td></tr>
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Prepared by,

SHAFIQ BIN RASULAN
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Date: 20/07/2023

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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 2: KINEMATICS OF MOTIONS
Chapter: 3: DYNAMICS OF LINEAR MOTION</td></tr>
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<tr><td>Monday
31/07/2023
9am-10am
BT1</td><td>K1</td><td>2.3a Describe projectile motion launched at an angle, as well as special cases when angle is zero
3.1a Define momentum and impulse, refer equation 2
3.2a State the principle of conservation of linear momentum.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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Prepared by,

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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td>Monday
07/08/2023
9am-10am
BT1</td><td>K1</td><td>3.2c Differentiate elastic and inelastic collisions. (remarks: similarities & differences)
3.3a Identify the forces acting on a body in different situations:
i. Weight, W; ii. Tension, T; iii. Normal force, N; iv. Friction, f; and
v. External force (pull or push), F.
3.4a State Newton's laws of motion.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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Prepared by,

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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 4: WORK, ENERGY AND POWER</td></tr>
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<tr><td>Monday
14/08/2023
9am-10am
BT1</td><td>K1</td><td>4.1a State the physical meaning of dot (scalar) product for work, refer equation 4.
4.1b Define and apply work done by a constant force.
4.2a Define and use: i. Gravitational potential energy, ii. Elastic potential energy for spring, iii. Kinetic energy. (Refer Equation 5)</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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SHAFIQ BIN RASULAN
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MOHD AIMAN BIN MOHD ADLI
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 4: WORK, ENERGY AND POWER
Chapter: 5: CIRCULAR MOTION</td></tr>
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<tr><td>Monday

21/08/2023

9am-10am

BT1</td><td>K1</td><td>4.2b State the principle of conservation of energy.
4.2d State and apply work-energy theorem (Refer equation 5)
4.3a Define and use average power and instantaneous power (Refer Equation 6)
5.1a Define and use: i. angular displacement, θ ii. period, T iii. frequency, f iv. angular velocity, ω
5.2a Describe uniform circular motion.</td><td>Discussion

Thought Experiments</td><td><table><tr><th>ITEM
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Prepared by,

SHAFIQ BIN RASULAN
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MOHD AIMAN BIN MOHD ADLI
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Date: 18/08/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 5: CIRCULAR MOTION
Chapter: 6: ROTATION OF RIGID BODY</td></tr>
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<tr><td>Monday

28/08/2023

9am-10am

BT1</td><td>K1</td><td>5.3a Explain centripetal acceleration and centripetal force (Refer equation 7)
6.1a Define and use: iangular displacement, θ; ii. average angular velocity, ωav, iii. instantaneous angular velocity, ω; iv. average angular acceleration, αav; and v. instantaneous angular acceleration, α.
6.2a State the physical meaning of cross (vector) product for torque (Refer equation 9)
6.2b Define and apply torque.
6.2c State conditions for equilibrium of rigid body, ΣF = 0, Στ = 0</td><td>Discussion

Thought Experiments</td><td><table><tr><th>ITEM
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SHAFIQ BIN RASULAN
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MOHD AIMAN BIN MOHD ADLI
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Date: 25/08/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 6: ROTATION OF RIGID BODY</td></tr>
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<tr>
<td>Monday
04/09/2023
9am-10am
BT1</td>
<td>K1</td>
<td>6.3a Define and use moment of inertia (Refer equation 10)
6.3d State and use net torque (Refer equation 10)
6.4a Explain and use angular momentum (Refer equation 11)
6.4b State and use principle of conservation of angular momentum.</td>
<td>Discussion
Thought Experiments</td>
<td>
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Prepared by,

SHAFIQ BIN RASULAN
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr>
<td>Monday
18/09/2023
9am-10am
BT1</td>
<td>K1</td>
<td>7.1a Explain SHM.
7.1d Emphasise the relationship between total SHM energy and amplitude.</td>
<td>Discussion
Thought Experiments</td>
<td>
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SHAFIQ BIN RASULAN
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
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<tr><td>Monday
25/09/2023
9am-10am
BT1</td><td>K1</td><td>7.4a Define wavelength.
7.4b Define and use wave number (Refer equation 14)
7.4d Distinguish between particle vibrational velocity and wave propagation velocity.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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Prepared by,

SHAFIQ BIN RASULAN
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Date: 22/09/2023

KOLEJ MATRIKULASI SARAWAK
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<tr>
<td>Monday
02/10/2023
9am-10am
BT1</td>
<td>K1</td>
<td>7.5a State the principle of superposition of waves for the constructive and destructive interferences.
7.5c Compare between progressive waves and standing waves.</td>
<td>Discussion
Thought Experiments</td>
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Prepared by,

SHAFIQ BIN RASULAN
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Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Date: 29/09/2023

KOLEJ MATRIKULASI SARAWAK
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Chapter: 8: PHYSICS OF MATTER</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Lecture</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO1: Describe basic concepts of mechanics, wave, matters, heat and thermodynamics</td></tr>
<tr><td colspan="2">SLT</td><td>F2F (hour):</td><td>1</td><td>NF2F (hour):</td><td>1</td></tr>
<tr><td>DAY
DATE
TIME
VENUE</td><td>CLASS</td><td>LEARNING OUTCOME</td><td>T&L STRATEGIES & TOOLS</td><td>REFLECTION</td><td>REMARKS</td></tr>
<tr><td>Monday
09/10/2023
9am-10am
BT1</td><td>K1</td><td>7.7a State Doppler Effect for sound waves.
8.1c Explain elastic and plastic deformations.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
*Appendix</th><th>SCORE</th></tr><tr><td>i</td><td>4</td></tr><tr><td>ii</td><td>3</td></tr><tr><td>iii</td><td>3</td></tr><tr><td>iv</td><td>3</td></tr><tr><td>v</td><td>4</td></tr></table></td><td>All objectives achieved. Students are able to understand the materials of the topic.</td></tr>
</table>

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 05/10/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 06/10/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
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<tr><td colspan="2">WEEK</td><td colspan="4">13</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 8: PHYSICS OF MATTER</td></tr>
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<tr><td>Monday
16/10/2023
9am-10am
BT1</td><td>K1</td><td>8.2a Define and use Young's Modulus (Refer equation 19)</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
*Appendix</th><th>SCORE</th></tr><tr><td>i</td><td>4</td></tr><tr><td>ii</td><td>3</td></tr><tr><td>iii</td><td>3</td></tr><tr><td>iv</td><td>3</td></tr><tr><td>v</td><td>4</td></tr></table></td><td>All objectives achieved. Students are able to understand the materials of the topic.</td></tr>
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SHAFIQ BIN RASULAN
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Date: 12/10/2023

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MOHD AIMAN BIN MOHD ADLI
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Date: 13/10/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td>Monday
23/10/2023
9am-10am
BT1</td><td>K1</td><td>8.3a Define heat conduction.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
*Appendix</th><th>SCORE</th></tr><tr><td>i</td><td>4</td></tr><tr><td>ii</td><td>3</td></tr><tr><td>iii</td><td>4</td></tr><tr><td>iv</td><td>4</td></tr><tr><td>v</td><td>3</td></tr></table></td><td>All objectives achieved. Students are able to understand the materials of the topic.</td></tr>
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SHAFIQ BIN RASULAN
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Date: 19/10/2023

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Sarawak Matriculation College
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
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<tr><td>Monday
30/10/2023
9am-10am
BT1</td><td>K1</td><td>8.4a Define coefficient of linear expansion, α, area expansion, β and volume expansion, γ</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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SHAFIQ BIN RASULAN
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Date: 26/10/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 27/10/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
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<tr><td colspan="2">WEEK</td><td colspan="4">16</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 9: KINETIC THEORY OF GASES AND THERMODYNAMICS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Lecture</td></tr>
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<tr><td>Monday
06/11/2023
9am-10am
BT1</td><td>K1</td><td>9.1a State the assumptions of kinetic theory of gases.
9.1b Describe root mean square (rms) speed of gas molecules (Refer equation 22)
9.2a Explain and use translational kinetic energy of a molecule (Refer equation 23)</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM *Appendix</th><th>SCORE</th></tr><tr><td>i</td><td>4</td></tr><tr><td>ii</td><td>3</td></tr><tr><td>iii</td><td>3</td></tr><tr><td>iv</td><td>3</td></tr><tr><td>v</td><td>4</td></tr></table></td><td>All objectives achieved. Students are able to understand the materials of the topic.</td></tr>
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Prepared by,

SHAFIQ BIN RASULAN
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Date: 02/11/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 03/11/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
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<tr>
<td>Monday
13/11/2023
9am-10am
BT1</td>
<td>K1</td>
<td>9.2b Define degree of freedom.
9.2c Identify number of degrees of freedom, ffor monoatomic, diatomic and polyatomic gas molecules.
9.2d State the principle of equipartition of energy.
9.2e Discuss internal energy of gas.</td>
<td>Discussion
Thought Experiments</td>
<td>
<table>
<tr><th>*Appendix</th><th>SCORE</th></tr>
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</table>

Prepared by,

SHAFIQ BIN RASULAN
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Date: 09/11/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 10/11/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">WEEK</td><td colspan="4">18</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 9: KINETIC THEORY OF GASES AND THERMODYNAMICS</td></tr>
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VENUE</td><td>CLASS</td><td>LEARNING OUTCOME</td><td>T&L STRATEGIES & TOOLS</td><td>REFLECTION</td><td>REMARKS</td></tr>
<tr><td>Monday
20/11/2023
9am-10am
BT1</td><td>K1</td><td>9.3a State the First Law of Thermodynamics (Refer equation 24)
9.4a Define the following thermodynamic processes: i. Isothermal; ii. Isochoric; iii. Isobaric and iv. Adiabatic.
9.4b Analyse P-V graph for all the thermodynamic processes.</td><td>Discussion
Thought Experiments</td><td><table><tr><th>ITEM
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 16/11/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 17/11/2023

Tutorials

KOLEJ MATRIKULASI SARAWAK

LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 1: PHYSICAL QUANTITIES AND MEASUREMENTS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Tutorial</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO2: Solve problems related to mechanics, wave, matters, heat and thermodynamics</td></tr>
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K1T2A(Tuesday);
K1T2B(Tuesday)
K1T1(18/07/2023);
K1T2A(18/07/2023);
K1T2B(18/07/2023)
K1T1(9am - 10am);
K1T2A(3pm - 4pm);
K1T2B(10am - 11am)
K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>1.1a) Define dimension.
1.1b) Determine the dimensions of derived quantities.
1.1c) Verify the homogeneity of equations using dimensional analysis.</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
<table>
<tr><th>*Appendix</th><th>SCORE</th></tr>
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Prepared by,

SHAFIQ BIN RASULAN
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MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
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KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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K1T2B(Wednesday)
K1T1(20/07/2023);
K1T2A(19/07/2023);
K1T2B(19/07/2023)
K1T1(10am -11am);
K1T2A(2pm - 3pm);
K1T2B(9am - 10am)
K1T1(DK1);
K1T2A(BT3);
K1T2B(BT3)</td>
<td>K1</td>
<td>1.2a) Define scalar and vector quantities.
1.2b) Resolve vector into two perpendicular components (x and y axes).
1.2c) Determine resultant of vectors. (remarks: limit to three vectors only).</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
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SHAFIQ BIN RASULAN
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Sarawak Matriculation College
Date: 13/07/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 14/07/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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K1T2B(Thursday)
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K1T2A(21/07/2023);
K1T2B(20/07/2023)
K1T1(11am - 12pm);
K1T2A(10am - 11am);
K1T2B(12pm-1pm)
K1T1(DK2);
K1T2A(MF);
K1T2B(BT1)</td>
<td>K1</td>
<td>1.3a) State the significant figures of a given number.
1.3b) Use the rules for stating the significant figures at the end of a calculation (addition, subtraction, multiplication or division).
1.3c) Determine the uncertainty for average value and derived quantities.
1.3d) Calculate basic combination (propagation) of uncertainties.
1.3e) State the sources of uncertainty in the results of an experiment.
1.3f) Draw a linear graph and determine its gradient, y-intercept and its respective uncertainties. (remarks: using Least Square Method LSM to determine uncertainties)
1.3g) Measure and determine the uncertainty of physical quantities. (Experiment 1: Measurement and uncertainty)</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
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Date: 13/07/2023

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MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 14/07/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 2: KINEMATICS OF MOTIONS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Tutorial</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO2: Solve problems related to mechanics, wave, matters, heat and thermodynamics</td></tr>
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K1T1(9am - 10am);
K1T2A(3pm - 4pm);
K1T2B(10am - 11am)
K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>2.1a) Define instantaneous velocity, average velocity, uniform velocity, instantaneous acceleration, average acceleration and uniform acceleration.
2.1b) Interpret the physical meaning of displacement-time, velocity-time and acceleration-time graphs.
2.1c) Determine the distance travelled, displacement, velocity and acceleration from appropriate graphs.</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 20/07/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 21/07/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 20/07/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 21/07/2023

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Date: 27/07/2023

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MOHD AIMAN BIN MOHD ADLI
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<td>K1</td>
<td>3.1a) Define momentum and impulse (Refer Equation 2)
3.1b) Solve 1D problems related to impulse and impulse-momentum theorem (Refer Equation 2)</td>
<td>Discussion

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SHAFIQ BIN RASULAN
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Date: 03/08/2023

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MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 04/08/2023

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<td>3.1c) Use F-t graph to determine impulse.</td>
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<td>3.2a) State the principle of conservation of linear momentum.
3.2b) Apply the principle of conservation of momentum in elastic and inelastic collisions in 2D collisions.
3.2c) Differentiate elastic and inelastic collisions. (remarks: similarities & differences)</td>
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<td>K1</td>
<td>3.3a) Identify the forces acting on a body in different situations – Weight, W; Tension, T; Normal force, N; Friction, f; and External force (pull or push), F.
3.3b) Sketch free body diagram.
3.3c) Determine static and kinetic friction (Refer Equation 3)</td>
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MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 10/08/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 11/08/2023

KOLEJ MATRIKULASI SARAWAK
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<td>K1</td>
<td>4.1a) State the physical meaning of dot (scalar) product for work (Refer Equation 4)
4.1b) Define and apply work done by a constant force.
4.1c) Determine work done from a force-displacement graph.</td>
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<td>K1</td>
<td>5.1a) Define and use – angular displacement, period, frequency, angular velocity</td>
<td>Discussion

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<td>5.2a) Describe uniform circular motion.
5.2b) Convert units between degrees, radian, and revolution or rotation.</td>
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K1T2A(MF);
K1T2B(BT1)</td>
<td>K1</td>
<td>5.3a) Explain centripetal acceleration and centripetal force (Refer Equation 7)
5.3b) Solve problems related to centripetal force for uniform circular motion cases: horizontal circular motion, vertical circular motion and conical pendulum, exclude banked curve</td>
<td>Discussion

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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 31/08/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 01/09/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>6.1a) Define and use – angular displacement, average angular velocity, instantaneous angular velocity, average angular acceleration, instantaneous angular acceleration. (Refer Equation 8)
6.1b) Analyse parameters in rotational motion with their corresponding quantities in linear motion (Refer Equation 8)
6.1c) Solve problem related to rotational motion with constant angular acceleration (Refer Equation 8)</td>
<td>Discussion

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SHAFIQ BIN RASULAN
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Sarawak Matriculation College
Date: 14/09/2023

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MOHD AIMAN BIN MOHD ADLI
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K1T1(DK1);
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<td>K1</td>
<td>6.2a) State the physical meaning of cross (vector) product for torque, (Refer Equation 9)
6.2b) Define and apply torque.
6.2c) State conditions for equilibrium of rigid body
6.2d) Solve problems related to equilibrium of a uniform rigid body, limit to 5 forces.</td>
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<td>6.2a) State the physical meaning of cross (vector) product for torque, (Refer Equation 9)
6.2b) Define and apply torque.
6.2c) State conditions for equilibrium of rigid body
6.2d) Solve problems related to equilibrium of a uniform rigid body, limit to 5 forces.</td>
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K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>6.3a) Define and use moment of inertia (Refer Equation 10)
6.3b) Use the moment of inertia of a uniform rigid body. (sphere, cylinder, ring, disc, and rod).
6.3c) Determine the moment of inertia of a flywheel. (Experiment 4: Rotational motion of rigid body) d) State and use net torque (Refer Equation 10)</td>
<td>Discussion

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SHAFIQ BIN RASULAN
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MOHD AIMAN BIN MOHD ADLI
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K1T2A(BT3);
K1T2B(BT3)</td>
<td>K1</td>
<td>6.4a) Explain and use angular momentum (Refer Equation 11)
6.4b) State and use principle of conservation of angular momentum.</td>
<td>Discussion

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K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>7.1a) Explain SHM.
7.1b) Apply SHM displacement equation (Refer Equation 12)
7.1c) Derive (without calculus) and use equations – velocity, acceleration, kinetic energy, and potential energy (Refer Equation 12)
7.1d) Emphasise the relationship between total SHM energy and amplitude.
7.1e) Apply equations of velocity, acceleration, kinetic energy and potential energy for SHM.</td>
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K1T1(DK1);
K1T2A(BT3);
K1T2B(BT3)</td>
<td>K1</td>
<td>7.2a) Analyse the following graphs – displacement-time, velocity-time, acceleration-time and energy-displacement.</td>
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K1T1(DK2);
K1T2A(MF);
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<td>K1</td>
<td>7.3a) Use expression for period of SHM, for simple pendulum and mass-spring system – Simple pendulum and mass-spring system (Refer Equation 13)
7.3b) Determine the acceleration, g due to gravity using simple pendulum.(Experiment 5: SHM)
7.3c) Investigate the effect of large amplitude oscillation to the accuracy of acceleration due to gravity, g obtained from the experiment. (Experiment 5: SHM)</td>
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SHAFIQ BIN RASULAN
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Date: 28/09/2023

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MOHD AIMAN BIN MOHD ADLI
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Date: 29/09/2023

KOLEJ MATRIKULASI SARAWAK
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SEMESTER I SESSION 2023/2024

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<td>K1</td>
<td>7.4a) Define wavelength.
7.4b) Define and use wave number (Refer Equation 14)
7.4c) Solve problems related to equation of progressive wave (Refer Equation 14)
7.4d) Distinguish between particle vibrational velocity and wave propagation velocity.
7.4e) Use particle vibrational velocity (Refer Equation 14)
7.4f) Use wave propagation velocity (Refer Equation 14)
7.4g) Analyse the graphs of – displacement-time and displacement-distance</td>
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MOHD AIMAN BIN MOHD ADLI
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 19/10/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 20/10/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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K1T2A(3pm - 4pm);
K1T2B(10am - 11am)
K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>8.1a) Distinguish between stress and strain for tensile and compression force. (Refer Equation 18)
8.1b) Analyse the graph of stress-strain, σ & for a metal under tension.
8.1c) Explain elastic and plastic deformations.
8.1d) Analyse graph of force-elongation for brittle and ductile materials.</td>
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SHAFIQ BIN RASULAN
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Date: 26/10/2023

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MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 27/10/2023

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K1T1(DK1);
K1T2A(BT3);
K1T2B(BT3)</td>
<td>K1</td>
<td>8.2a) Define and use Young's Modulus (Refer Equation 19)
8.2b) Apply strain energy from force-elongation graph. (Refer Equation 19)
8.2c) Apply strain energy per unit volume from stress-strain graph. (Refer Equation 19)</td>
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<td>8.2a) Define and use Young's Modulus (Refer Equation 19)
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LESSON PLAN
SEMESTER I SESSION 2023/2024

LECTURER		SHAFIQ BIN RASULAN			
CODE / COURSE		SP015			
WEEK		16			
CHAPTER		Chapter: 8: PHYSICS OF MATTER			
MODE		Tutorial			
CLO		CLO2: Solve problems related to mechanics, wave, matters, heat and thermodynamics			
SLT		**F2F (hour):**	1	**NF2F (hour):**	1
DAY DATE TIME VENUE	**CLASS**	**LEARNING OUTCOME**	**T&L STRATEGIES & TOOLS**	**REFLECTION**	**REMARKS**
K1T1(Tuesday); K1T2A(Tuesday); K1T2B(Tuesday) K1T1(07/11/2023); K1T2A(07/11/2023); K1T2B(07/11/2023) K1T1(9am - 10am); K1T2A(3pm - 4pm); K1T2B(10am - 11am) K1T1(BT3); K1T2A(BT1); K1T2B(MF)	K1	8.3a) Define heat conduction. 8.3b) Solve problems related to rate of heat transfer through a cross-sectional area (remarks: maximum two insulated objects in series) (Refer Equation 20) 8.3c) Analyse graphs of temperature-distance (T-L) for heat conduction through insulated and non-insulated rods, maximum two rods in series.	Discussion Thought Experiments Problem Practice	**ITEM** ***Appendix*** / **SCORE** **i** 4 **ii** 4 **iii** 3 **iv** 4 **v** 4	All objectives achieved. Students are able to understand the materials of the topic.

Prepared by,

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Date: 02/11/2023

Endorsed by,

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Date: 03/11/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
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<td>K1</td>
<td>8.3a) Define heat conduction.
8.3b) Solve problems related to rate of heat transfer through a cross-sectional area (remarks: maximum two insulated objects in series) (Refer Equation 20)
8.3c) Analyse graphs of temperature-distance (T-L) for heat conduction through insulated and non-insulated rods, maximum two rods in series.</td>
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Sarawak Matriculation College
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K1T2B(12pm-1pm)
K1T1(DK2);
K1T2A(MF);
K1T2B(BT1)</td>
<td>K1</td>
<td>8.4a) Define coefficient of linear expansion, a, area expansion, ß and volume expansion, y
8.4b) Solve problems related to thermal expansion of linear, area and volume, include expansion of liquid in a container. (Refer Equation 21)</td>
<td>Discussion

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K1T2A(3pm - 4pm);
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K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>9.1a) State the assumptions of kinetic theory of gases.
9.1b) Describe root mean square (rms) speed of gas molecules (Refer Equation 22)
9.1c) Solve problems related to root mean square (rms) speed of gas molecules (Refer Equation 22)
9.1d) Solve problems related to the equations and pressure (Refer Equation 22)</td>
<td>Discussion

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MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
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K1T1(DK1);
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K1T2B(BT3)</td>
<td>K1</td>
<td>9.2a) Explain and use translational kinetic energy of a molecule (Refer Equation 23)
9.2b) Define degree of freedom.
9.2c) Identify number of degrees of freedom, f for monoatomic, diatomic and polyatomic gas molecules.
9.2d) State the principle of equipartition of energy.
9.2e) Discuss internal energy of gas.
9.2f) Solve problems related to internal energy (Refer Equation 23)</td>
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K1T2B(Tuesday)
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K1T2A(21/11/2023);
K1T2B(21/11/2023)
K1T1(9am - 10am);
K1T2A(3pm - 4pm);
K1T2B(10am - 11am)
K1T1(BT3);
K1T2A(BT1);
K1T2B(MF)</td>
<td>K1</td>
<td>9.3a) State the First Law of Thermodynamics (Refer Equation 24)
9.3b) Solve problem related to First Law of Thermodynamics.</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
<table>
<tr><th>ITEM
*Appendix</th><th>SCORE</th></tr>
<tr><td>i</td><td>4</td></tr>
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</td>
<td>All objectives achieved. Students are able to understand the materials of the topic.</td>
</tr>
</table>

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 16/11/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 17/11/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

<table>
<tr><td colspan="2">LECTURER</td><td colspan="4">SHAFIQ BIN RASULAN</td></tr>
<tr><td colspan="2">CODE / COURSE</td><td colspan="4">SP015</td></tr>
<tr><td colspan="2">WEEK</td><td colspan="4">18</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter: 9: KINETIC THEORY OF GASES AND THERMODYNAMICS</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Tutorial</td></tr>
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K1T2A(22/11/2023);
K1T2B(22/11/2023)
K1T1(10am -11am);
K1T2A(2pm - 3pm);
K1T2B(9am - 10am)
K1T1(DK1);
K1T2A(BT3);
K1T2B(BT3)</td>
<td>K1</td>
<td>9.4a) Define the following thermodynamic processes – Isothermal, Isochoric, Isobaric and Adiabatic.
9.4b) Analyse P-V graph for all the thermodynamic processes.</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
<table>
<tr><th>ITEM
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SHAFIQ BIN RASULAN
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Date: 16/11/2023

Endorsed by,

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Date: 17/11/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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K1T1(11am - 12pm);
K1T2A(10am - 11am);
K1T2B(12pm-1pm)
K1T1(DK2);
K1T2A(MF);
K1T2B(BT1)</td>
<td>K1</td>
<td>9.5a) Derive equation of work done in isothermal, isochoric and isobaric processes from P-V graph.
9.5b) Solve problem related to work done in isothermal process, isobaric process, and isochoric process (Refer Equation 25)</td>
<td>Discussion

Thought Experiments

Problem Practice</td>
<td>
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SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 16/11/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
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Sarawak Matriculation College
Date: 17/11/2023

Labs

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter 1: Physical Quantities And Measurements</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Laboratory/ Physics Practicals</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO3: Apply the appropriate scientific laboratory skills in physics experiments</td></tr>
<tr><td colspan="2">SLT</td><td>F2F (hour):</td><td>1</td><td>NF2F (hour):</td><td>1</td></tr>
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Thursday (K1T2)
02/08/2023(K1T1)
03/08/2023(K1T2)
1100 - 1300(K1T1)
1400 - 1500(K1T2)
Physics Lab (Makmal Fizik)</td>
<td>K1</td>
<td>Experiment 1: Measurement and Safety
1.3g: Measure and determine the uncertainty of physical quantities.(Experiment I : Measurement and uncertainty)</td>
<td>Laboratory Work</td>
<td>
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
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Date: 27/07/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 28/07/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

LECTURER		SHAFIQ BIN RASULAN			
CODE / COURSE		SP015			
WEEK		4			
CHAPTER		Chapter 2: Kinematics Of Motions			
MODE		Laboratory/ Physics Practicals			
CLO		CLO3: Apply the appropriate scientific laboratory skills in physics experiments			
SLT		**F2F (hour):**	1	**NF2F (hour):**	1
DAY **DATE** **TIME** **VENUE**	**CLASS**	**LEARNING OUTCOME**	**T&L STRATEGIES & TOOLS**	**REFLECTION**	**REMARKS**
Wednesday (K1T1) Thursday (K1T2) 09/08/2023(K1T1) 10/08/2023(K1T2) 1100 - 1300(K1T1) 1400 - 1500(K1T2) Physics Lab (Makmal Fizik)	K1	Experiment 2: Free Fall & Projectile Motion 2.3c: Determine the acceleration due to gravity, g using free fall and projectile motion. (Experiment 2: Free fall and projectile motion)	Laboratory Work	**ITEM** / ***Appendix*** — **SCORE** **i** — 4 **ii** — 4 **iii** — 4 **iv** — 3 **v** — 4	All objectives achieved. Students are able to understand the materials of the topic.

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 03/08/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 04/08/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

LECTURER		SHAFIQ BIN RASULAN			
CODE / COURSE		SP015			
WEEK		6			
CHAPTER		Chapter 4: Work, Energy And Power			
MODE		Laboratory/ Physics Practicals			
CLO		CLO3: Apply the appropriate scientific laboratory skills in physics experiments			
SLT		**F2F (hour):**	1	**NF2F (hour):**	1
DAY **DATE** **TIME** **VENUE**	**CLASS**	**LEARNING OUTCOME**	**T&L STRATEGIES & TOOLS**	**REFLECTION**	**REMARKS**
Wednesday (K1T1) Thursday (K1T2) 23/08/2023(K1T1) 24/08/2023(K1T2) 1100 - 1300(K1T1) 1400 - 1500(K1T2) Physics Lab (Makmal Fizik)	K1	Experiment 3: Energy 4.3b: Verify the law of conservation of energy.(Experiment 3: Energy)	Laboratory Work	**ITEM** / ***Appendix*** — **SCORE** **i** — 4 **ii** — 4 **iii** — 4 **iv** — 3 **v** — 4	All objectives achieved. Students are able to understand the materials of the topic.

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 17/08/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 18/08/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

LECTURER		SHAFIQ BIN RASULAN			
CODE / COURSE		SP015			
WEEK		7			
CHAPTER		Chapter 6: Rotation Of Rigid Body			
MODE		Laboratory/ Physics Practicals			
CLO		CLO3: Apply the appropriate scientific laboratory skills in physics experiments			
SLT		**F2F (hour):**	1	**NF2F (hour):**	1
DAY **DATE** **TIME** **VENUE**	**CLASS**	**LEARNING OUTCOME**	**T&L STRATEGIES & TOOLS**	**REFLECTION**	**REMARKS**
Wednesday (K1T1) Thursday (K1T2) 30/08/2023(K1T1) 31/08/2023(K1T2) 1100 - 1300(K1T1) 1400 - 1500(K1T2) Physics Lab (Makmal Fizik)	K1	Experiment 4: Rotational Motion of Rigid Body 6.3c: Determine the moment of inertia of a flywheel. (Experiment 4: Rotational motion of rigid body)	Laboratory Work	**ITEM** / ***Appendix*** — **SCORE** **i** — 4 **ii** — 4 **iii** — 4 **iv** — 3 **v** — 4	All objectives achieved. Students are able to understand the materials of the topic.

Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 24/08/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 25/08/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">WEEK</td><td colspan="4">9</td></tr>
<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter 7: Oscillations And Waves</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Laboratory/ Physics Practicals</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO3: Apply the appropriate scientific laboratory skills in physics experiments</td></tr>
<tr><td colspan="2">SLT</td><td>F2F (hour):</td><td>1</td><td>NF2F (hour):</td><td>1</td></tr>
<tr><td>DAY
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Thursday (K1T2)
20/09/2023(K1T1)
21/09/2023(K1T2)
1100 - 1300(K1T1)
1400 - 1500(K1T2)
Physics Lab (Makmal Fizik)</td>
<td>K1</td>
<td>Experiment 5: Simple Harmonic Motion
7.3b: Determine the acceleration, g due to gravity using simple pendulum. (Experiment 5: SHM)
7.3c: Investigate the effect of large amplitude oscillation to the accuracy of acceleration due to gravity, g obtained from the experiment. (Experiment 5: SHM)</td>
<td>Laboratory Work</td>
<td>
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Prepared by,

SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 14/09/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 15/09/2023

KOLEJ MATRIKULASI SARAWAK
LESSON PLAN
SEMESTER I SESSION 2023/2024

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<tr><td colspan="2">CHAPTER</td><td colspan="4">Chapter 7: Oscillations And Waves</td></tr>
<tr><td colspan="2">MODE</td><td colspan="4">Laboratory/ Physics Practicals</td></tr>
<tr><td colspan="2">CLO</td><td colspan="4">CLO3: Apply the appropriate scientific laboratory skills in physics experiments</td></tr>
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04/10/2023(K1T1)
05/10/2023(K1T2)
1100 - 1300(K1T1)
1400 - 1500(K1T2)
Physics Lab (Makmal Fizik)</td>
<td>K1</td>
<td>Experiment 6: Standing Waves
7.6c: Investigate standing wave formed in a stretched string. (Experiment 6: Standing waves)
7.6d: Determine the mass per unit length of the string.(Experiment 6: Standing waves)</td>
<td>Laboratory Work</td>
<td>
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SHAFIQ BIN RASULAN
Physics Lecturer
Sarawak Matriculation College
Date: 28/09/2023

Endorsed by,

MOHD AIMAN BIN MOHD ADLI
Head of the Physics Unit
Sarawak Matriculation College
Date: 29/09/2023

Equation No	LO	Equations
1	2.2	$v = u + at; v^2 = u^2 + 2as;\ s = ut + \frac{1}{2}at^2; s = \frac{1}{2}(u + v)t$
2	3.1	$J = F\Delta t; J = \Delta p = m(v - u)$
3	3.3	$f_s \leq \mu_s N; f_k = \mu_k N$
4	4.1	$W = \vec{F} \cdot \vec{s} = Fs\cos\theta$
5	4.2	$U = mgh; U_s = \frac{1}{2}kx^2 = \frac{1}{2}Fx; K = \frac{1}{2}mv^2; W = \Delta K$
6	4.3	$P_{av} = \frac{\Delta W}{\Delta t}; P = \vec{F} \cdot \vec{v}$
7	5.3	$a_c = \frac{v^2}{r} = r\omega^2 = v\omega;\ F_c = \frac{mv^2}{r} = mr\omega^2 = mv\omega$
8	6.1	$s = r\theta;\ v = r\omega;\ a_t = r\alpha;\ a_c = r\omega^2 = \frac{v^2}{r}$ $\omega = \omega_o + \alpha t;\ \theta = \omega_o + \frac{1}{2}\alpha t^2;\ \omega^2 = \omega_o + 2\alpha\theta; \theta = \frac{1}{2}(\omega_o + \omega)t$
9	6.2	$\lvert\vec{\tau}\rvert = rF\sin\theta; \Sigma F = \Sigma\tau = 0$
10	6.3	$I = \Sigma mr^2; \Sigma\tau = I\alpha$
11	6.4	$L = I\ \omega$
12	7.1	$y = A\sin(\omega t);\ v = \omega A\cos(\omega t) = \pm\omega\sqrt{A^2 - y^2}$ $a = -\omega^2 A\sin(\omega t) = -\omega^2 y;\ K = \frac{1}{2}m\omega^2(a^2 - y^2);\ U = \frac{1}{2}m\omega^2 y^2$
13	7.3	$T = 2\pi\sqrt{\frac{l}{g}};\ T = 2\pi\sqrt{\frac{m}{k}}$
14	7.4	$k = \frac{2\pi}{\lambda};\ y(x,t) = A\sin(\omega t \pm kx);\ v_y = A\omega(\omega t \pm kx);\ v = f\lambda$
15	7.5	$y = 2A\cos(kx)\sin(\omega t)$
16	7.6	$f_n = \frac{nv}{2L};\ f_n = \frac{nv}{4L};\ v = \sqrt{\frac{T}{\mu}}$
17	7.7	$f_a = \left(\frac{v \pm v_o}{v \mp v_s}\right)f$
18	8.1	$\delta = \frac{F}{A};\ \varepsilon = \frac{\Delta L}{L_o}$
19	8.2	$Y = \frac{\delta}{\varepsilon};\ U = \frac{1}{2}F\Delta L;\ \frac{U}{V} = \frac{1}{2}\delta\varepsilon$
20	8.3	$\frac{Q}{t} = -kA\left(\frac{\Delta T}{L}\right)$
21	8.4	$\Delta L = \alpha L_o\Delta T;\ \Delta A = \beta A_o\Delta T;\ \Delta V = \gamma V_o\Delta T;\ \beta = 2\alpha;\ \gamma = 2\alpha$
22	9.1	$v_{rms} = \sqrt{< v^2 >};\ v_{rms} = \sqrt{\frac{2kT}{m}} = \sqrt{\frac{2RT}{M}}$ $PV = \frac{1}{3}Nmv_{rms}^2;\ P = \frac{1}{3}\rho v_{rms}^2$
23	9.2	$K_{tr} = \frac{3}{2}\left(\frac{R}{N_A}\right)T = \frac{3}{2}kT;\ U = \frac{1}{2}fNkT$
24	9.3	$\Delta U\ =\ Q - W$
25	9.5	$W = nRT\ ln\left(\frac{V_f}{V_i}\right) = nRT\ ln\left(\frac{P_i}{P_f}\right)$ $W = \int P\ dV = P(V_f - V_i);\ W = \int P\ dV = 0$