KEMENTERIAN PENDIDIKAN

B5: Huraian Sukatan Pelajaran (Curriculum Specifications)

SP015

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

1.	Name and code of course:	Physics 1 (SP015)
2.	Synopsis:	This course is offered to students to acquire concepts in physics as well as to enhance students' manipulative skills through practical sessions.
3.	Name(s) of academic staff:	Aifaa binti Awang Kechik
4.	Semester offered:	Semester I
5.	Credit value:	5
6.	Prerequisite/ co-requisite (if any):	None
7.	Course Learning Outcomes (CLO): At the end of the course, students should be able to: 1. Describe basic concepts of mechanics, waves, matters, heat and thermodynamics. (C2, PLO 1, MQF LOC i) 2. Solve problems related to mechanics, waves, matters, heat and thermodynamics. (C4, PLO 2, MQF LOC ii) 3. Apply the appropriate scientific laboratory skills in physics experiments. (P3, PLO 3, MQF LOC iii a) *Note*: *The **MQF 2.0 learning outcomes clusters** (**LOC**) are*: *i. Knowledge and understanding* *ii. Cognitive skills* *iii. Functional work skills with focus on:* *a. Practical skills* *b. Interpersonal skills* *c. Communication skills* *d. Digital skills* *e. Numeracy skills* *f. Leadership, autonomy and responsibility* *iv. Personal and entrepreneurial skills* *v. Ethics and professionalism*	

BAHAGIAN MATRIKULASI KEMENTERIAN PENDIDIKAN MALAYSIA

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

8. Mapping of Programme Learning Outcomes (PLO) to Programme Educational Objectives (PEO)

PEO / PLO	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
PLO 1	✓				
PLO 2		✓			
PLO 3	✓				
PLO 4			✓		
PLO 5			✓		
PLO 6				✓	
PLO 7		✓			
PLO 8					✓
PLO 9				✓	
PLO 10					✓

Programme Educational Objectives (PEO)

Upon a year of graduation from the programme, graduates are:

PEO 1 Knowledgeable and technically competent in science disciplines study in-line with higher educational institution requirement.
PEO 2 Able to apply information and use data to solve problems in science disciplines.
PEO 3 Able to communicate competently and collaborate effectively in group work to compete in higher education environment.
PEO 4 Able to use basic information technologies and engage in life-long learning to continue the acquisition of new knowledge and skills.
PEO 5 Able to demonstrate leadership skills and practice good values and ethics in managing organisations.

Programme Learning Outcomes (PLO)

At the end of the programme, students should be able to:

PLO 1 Acquire knowledge of science and mathematics as a fundamental of higher level education.
PLO 2 Apply logical, analytical and critical thinking in scientific studies and problem solving.
PLO 3 Demonstrate manipulative skills in laboratory works.
PLO 4 Collaborate in group work with skills required for higher education.
PLO 5 Deliver ideas, information, problems and solution in verbal and written communication.
PLO 6 Use basic digital technology to seek and analyse data for management of information.
PLO 7 Interpret familiar and uncomplicated numerical data to solve problems.
PLO 8 Demonstrate leadership, autonomy and responsibility in managing organization.
PLO 9 Initiate self-improvement through independent learning.
PLO 10 Practice good values attitude, ethics and accountability in STEM and professionalism.

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

9. Mapping of Course Learning Outcomes (CLO) to Programme Learning Outcomes (PLO), Teaching Methods and Assessment Methods:

CLO \ PLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	Teaching Method	Assessment Method
CLO 1	✓										Lecture	Summative Assessment Test
CLO 2		✓									Tutorial	Examination Assignment Lab Report
CLO 3			✓								Practical	Practical Test

(This description must be read together with Standard 2.1.2, 2.2.1 and 2.2.2 in Area 2)

10. Transferable Skills (if applicable): Critical Thinking and Problem Solving

11. Distribution of Student Learning Time (SLT):

Course Content Outline	CLO	Learning & Teaching Activities: Guided Learning e-Learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total SLT
1.0 Physical Quantities and Measurements 1.1 Dimensions of physical quantities 1.2 Scalars and vectors 1.3 Significant figures and uncertainties analysis	1, 2, 3	1	3.5	2	0	0	4.5	11
2.0 Kinematics of Linear Motion 2.1 Linear motion 2.2 Uniformly accelerated motion 2.3 Projectile motion	1, 2, 3	1.5	8	2	0	0	9.5	21
3.0 Dynamics of Linear Motion 3.1 Momentum and impulse 3.2 Conservation of linear momentum 3.3 Basic of forces and free body diagram 3.4 Newton's Laws of Motion	1, 2	1.5	8	0	0	0	9.5	19
4.0 Work, Energy and Power 4.1 Work 4.2 Energy and Conservation of Energy 4.3 Power	1, 2, 3	1.5	7	2	0	0	8.5	19
5.0 Circular Motion 5.1 Parameters in circular motion 5.2 Uniform circular motion 5.3 Centripetal force	1, 2	1	2.5	0	0	0	3.5	7

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

6.0 Rotation of Rigid Body 6.1 Rotational kinematics 6.2 Equilibrium of a uniform rigid body 6.3 Rotational dynamics 6.4 Conservation of angular momentum	1, 2, 3	1.5	7	2	0	0	8.5	19
7.0 Oscillations and Waves 7.1 Kinematics of simple harmonic motion 7.2 Graphs of simple harmonic motion 7.3 Period of simple harmonic motion 7.4 Properties of waves 7.5 Superposition of waves 7.6 Application of standing waves 7.7 Doppler Effect	1,2,3	3.5	18	4	0	0	21.5	47
8.0 Physics of Matters 8.1 Stress and strain 8.2 Young's Modulus 8.3 Heat conduction 8.4 Thermal expansion	1, 2	3.5	5	0	0	0	8.5	17
9.0 Kinetic Theory of Gases and Thermodynamics 9.1 Kinetic theory of gases 9.2 Molecular kinetic energy and internal energy 9.3 First Law of Thermodynamics 9.4 Thermodynamic processes 9.5 Thermodynamic work	1, 2	3	7	0	0	0	10	20
Total		**18**	**66**	**12**	**0**	**0**	**84**	**180**

Continuous Assessment	**Percentage (%)**	**F2F**	**NF2F**	**Total SLT**
1. Assignment (Topic 6 - CTPS)	10	0	3	3
2. Practical Test	15	1	3	4
3. Lab Report	15	1	3	4
Final Assessment	**Percentage (%)**	**F2F**	**NF2F**	**Total SLT**
1. Summative Assessment Test	20	1.5	4.5	6
2. Examination	40	2	6	8
GRAND TOTAL SLT				**205**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face-to-Face, NF2F = Non Face-to-Face

12.	Special requirement or resources:	None

BAHAGIAN MATRIKULASI * KEMENTERIAN PENDIDIKAN MALAYSIA *

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

13.	References:	Cutnell, J. D., Johnson, K. W., Young, D., & Stadler, S. (2019). *Introduction to Physics* (11th ed.). Hoboken, N.J: John Wiley & Sons. Serway, R. A. & Jewett, J. A. (2019). *Physics for Scientists and Engineers* (10th ed.). International Student Edition. USA: Brooks/ Cole Cengage Learning. Giancoli, D. C. (2016). *Physics – Principles with Application* (7th ed.). Prentice Hall.
14.	Other additional information:	Teaching Learning Outcomes:

Topic 1: Physical Quantities and Measurements

1.1 Dimensions of physical quantities
- a) Define dimension.
- b) Determine the dimensions of derived quantities.
- c) Verify the homogeneity of equations using dimensional analysis.

1.2 Scalars and vectors
- a) Define scalar and vector quantities.
- b) Resolve vector into two perpendicular components (x and y axes).
- c) Determine resultant of vectors. (remarks: limit to three vectors only).

1.3 Significant figures and uncertainties analysis (Laboratory works)
- a) State the significant figures of a given number.
- b) Use the rules for stating the significant figures at the end of a calculation (addition, subtraction, multiplication or division).
- c) Determine the uncertainty for average value and derived quantities.
- d) Calculate basic combination (propagation) of uncertainties.
- e) State the sources of uncertainty in the results of an experiment.
- f) Draw a linear graph and determine its gradient, y-intercept and its respective uncertainties. (remarks: using Least Square Method LSM to determine uncertainties)
- g) Measure and determine the uncertainty of physical quantities. (Experiment 1: Measurement and uncertainty)

Topic 2: Kinematics of Linear Motion

2.1 Linear motion
- a) Define:
  - i. instantaneous velocity, average velocity and uniform velocity; and
  - ii. instantaneous acceleration, average acceleration and uniform acceleration.
- b) Interpret the physical meaning of displacement-time, velocity-time and acceleration-time graphs.
- c) Determine the distance travelled, displacement, velocity and acceleration from appropriate graphs.

2.2 Uniformly accelerated motion
- a) Derive and apply equations of motion with uniform acceleration

$$v = u + at \; ; \; v^2 = u^2 + 2as \; ; \; s = ut + \frac{1}{2}at^2 \; ; \; s = \frac{1}{2}(u + v)t$$

2.3 Projectile motion
a) Describe projectile motion launched at an angle, θ as well as special cases when θ=0°
b) Solve problems related to projectile motion.
c) Determine the acceleration due to gravity, g using free fall and projectile motion.
(Experiment 2: Free fall and projectile motion)

Topic 3: Dynamics of Linear Motion

3.1 Momentum and impulse
a) Define momentum and impulse, $J = F\Delta t$
b) Solve problem related to impulse and impulse-momentum theorem,
$J = \Delta p = mv - mu$
**1D only*
c) Use *F-t* graph to determine impulse.

3.2 Conservation of linear momentum
a) State the principle of conservation of linear momentum.
b) Apply the principle of conservation of momentum in elastic and inelastic collisions in 2D collisions.
c) Differentiate elastic and inelastic collisions. (remarks: similarities & differences)

3.3 Basic of forces and free body diagram
a) 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.*
b) Sketch free body diagram.
c) Determine static and kinetic friction, $f_s \leq \mu_s N$, $f_k = \mu_k N$

3.4 Newton's Laws of Motion
a) State Newton's laws of motion.
b) Apply Newton's laws of motion.
**include static and dynamic equilibrium for Newton's first law motion*

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

Topic 4: Work, Energy and Power

4.1 Work
a) State the physical meaning of dot (scalar) product for work :
$W = \vec{F} \bullet \vec{s} = Fscos\theta$
b) Define and apply work done by a constant force.
c) Determine work done from a force-displacement graph.

4.2 Energy and Conservation of Energy
a) Define and use:
i. Gravitational potential energy, $U = mgh$
ii. Elastic potential energy for spring, $U_s = \frac{1}{2}kx^2 = \frac{1}{2}Fx$
iii. Kinetic energy, $K = \frac{1}{2}mv^2$
b) State the principle of conservation of energy.
c) Apply the principle of conservation of mechanical energy.
d) State and apply work-energy theorem, $W = \Delta K$

4.3 Power
a) Define and use average power, $P_{av} = \frac{\Delta W}{\Delta t}$ and instantaneous power, $P = \vec{F} \bullet \vec{v}$
b) Verify the law of conservation of energy.
(Experiment 3: Energy)

Topic 5: Circular Motion

5.1 Parameters in circular motion
a) Define and use:
i. angular displacement, θ
ii. period, T
iii. frequency, f
iv. angular velocity, ω

5.2 Uniform circular motion
a) Describe uniform circular motion.
b) Convert units between degrees, radian, and revolution or rotation.

5.3 Centripetal force
a) Explain centripetal acceleration and centripetal force, $a_c = \frac{v^2}{r} = r\omega^2 = v\omega$
and $F_c = \frac{mv^2}{r} = mr\omega^2 = mv\omega$
b) Solve problems related to centripetal force for uniform circular motion cases: horizontal circular motion, vertical circular motion and conical pendulum.
**exclude banked curve*

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

Topic 6: Rotation of Rigid Body

6.1 Rotational kinematics

a) Define and use:
   i. angular displacement, θ;
   ii. average angular velocity, ω_{av};
   iii. instantaneous angular velocity, ω;
   iv. average angular acceleration, α_{av}; and
   v. instantaneous angular acceleration, α.

b) Analyse parameters in rotational motion with their corresponding quantities in linear motion:
   $s = r\theta$, $v = r\omega$, $a_t = r\alpha$, $a_c = r\omega^2 = \frac{v^2}{r}$

c) Solve problem related to rotational motion with constant angular acceleration:
   $\omega = \omega_o + \alpha t$, $\theta = \omega_o + \frac{1}{2}\alpha t^2$, $\omega^2 = {\omega_o}^2 + 2\alpha\theta$, $\theta = \frac{1}{2}(\omega_o + \omega)t$

6.2 Equilibrium of a uniform rigid body

a) State the physical meaning of cross (vector) product for torque, $|\vec{\tau}| = rFsin\theta$
b) Define and apply torque.
c) State conditions for equilibrium of rigid body, $\sum F = 0, \sum \tau = 0$
d) Solve problems related to equilibrium of a uniform rigid body.
   **limit to 5 forces*

6.3 Rotational dynamics

a) Define and use moment of inertia, $I = \sum mr^2$
b) Use the moment of inertia of a uniform rigid body.
   (sphere, cylinder, ring, disc, and rod).
c) Determine the moment of inertia of a flywheel.
   (Experiment 4: Rotational motion of rigid body)
d) State and use net torque, $\sum \tau = I\alpha$

6.4 Conservation of angular momentum

a) Explain and use angular momentum, $L = I\omega$
b) State and use principle of conservation of angular momentum.

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

Topic 7: Oscillations and Waves

7.1 Kinematics of simple harmonic motion
- a) Explain SHM.
- b) Apply SHM displacement equation, $y = A\sin\omega t$
- c) Derive and use equations:
  - i. velocity, $v = \omega A cos\omega t = \pm\omega\sqrt{A^2 - y^2}$
  - ii. acceleration, $a = -\omega^2 A\sin\omega t = -\omega^2 y$
    (remarks: No calculus. Derive use algebra and trigonometry method, refer reference book Cutnell)
  - iii. kinetic energy, $K = \frac{1}{2}m\omega^2(A^2 - y^2)$
  - iv. potential energy, $U = \frac{1}{2}m\omega^2 y^2$
- d) Emphasise the relationship between total SHM energy and amplitude.
- e) Apply equations of velocity, acceleration, kinetic energy and potential energy for SHM.

7.2 Graphs of simple harmonic motion
- a) Analyse the following graphs:
  - i. displacement-time;
  - ii. velocity-time;
  - iii. acceleration-time; and
  - iv. energy-displacement.

7.3 Period of simple harmonic motion
- a) Use expression for period of SHM, T for simple pendulum and mass-spring system.
  Simple pendulum : $T = 2\pi\sqrt{\frac{l}{g}}$, mass-spring system : $T = 2\pi\sqrt{\frac{m}{k}}$
- b) Determine the acceleration, g due to gravity using simple pendulum.
  (Experiment 5: SHM)
- c) Investigate the effect of large amplitude oscillation to the accuracy of acceleration due to gravity, g obtained from the experiment.
  (Experiment 5: SHM)

7.4 Properties of waves
- a) Define wavelength.
- b) Define and use wave number, $k = \frac{2\pi}{\lambda}$
- c) Solve problems related to equation of progressive wave, $y(x, t) = A\sin(\omega t \pm kx)$
- d) Distinguish between particle vibrational velocity and wave propagation velocity.
- e) Use particle vibrational velocity, $v_y = A\omega\cos(\omega t \pm kx)$
- f) Use wave propagation velocity, $v = f\lambda$
- g) Analyse the graphs of:
  - i. displacement–time, *y-t*
  - ii. displacement–distance, *y-x*

7.5 Superposition of waves
- a) State the principle of superposition of waves for the constructive and destructive interferences.
- b) Use the standing wave equation, $y = 2A\ coskx\ sin\omega t$
- c) Compare between progressive waves and standing waves.

7.6 Application of standing waves

a) Solve problems related to the fundamental and overtone frequencies for:
   i. stretched string, $f_n = \frac{nv}{2L}$ and
   ii. air columns (open, $f_n = \frac{nv}{2L}$ and closed end, $f_n = \frac{nv}{4L}$).

b) Use wave speed in a stretched string, $v = \sqrt{\frac{T}{\mu}}$

c) Investigate standing wave formed in a stretched string.
(Experiment 6: Standing waves)

d) Determine the mass per unit length of the string.
(Experiment 6: Standing waves)

7.7 Doppler Effect

a) State Doppler Effect for sound waves.

b) Apply Doppler Effect equation $f_a = \left(\frac{v \pm v_o}{v \mp v_s}\right) f$ for relative motion between source and observer. Limit to stationary observer and moving source, and vice versa.

Topic 8: Physics of Matters

8.1 Stress and strain

a) Distinguish between stress, $\sigma = \frac{F}{A}$ and strain, $\varepsilon = \frac{\Delta L}{L_o}$ for tensile and compression force.

b) Analyse the graph of stress-strain, $\sigma - \varepsilon$ for a metal under tension.

c) Explain elastic and plastic deformations.

d) Analyse graph of force–elongation, F–ΔL for brittle and ductile materials.

8.2 Young's Modulus

a) Define and use Young's Modulus, $Y = \frac{\sigma}{\varepsilon}$.

b) Apply strain energy, $U = \frac{1}{2} F \Delta L$ from force-elongation graph.

c) Apply strain energy per unit volume, $\frac{U}{V} = \frac{1}{2}\sigma\varepsilon$ from stress-strain graph.

8.3 Heat conduction

a) Define heat conduction.

b) Solve problems related to rate of heat transfer, $\frac{Q}{t} = -kA\left(\frac{\Delta T}{L}\right)$ through a cross-sectional area (remarks: maximum two insulated objects in series)

c) Analyse graphs of temperature-distance (T-L) for heat conduction through insulated and non-insulated rods.
**maximum two rods in series*

8.4 Thermal expansion

a) Define coefficient of linear expansion, α, area expansion, β and volume expansion, γ

b) Solve problems related to thermal expansion of linear, area and volume.
**include expansion of liquid in a container*
$\Delta L = \alpha L_o \Delta T$, $\Delta A = \beta A_o \Delta T$, $\Delta V = \gamma V_o \Delta T$, $\beta = 2\alpha$, $\gamma = 3\alpha$

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

Topic 9: Kinetic Theory of Gases and Thermodynamics

9.1 Kinetic theory of gases
a) State the assumptions of kinetic theory of gases.
b) Describe root mean square (rms) speed of gas molecules, $v_{rms} = \sqrt{\langle v^2 \rangle}$
c) Solve problems related to root mean square (rms) speed of gas molecules,
$$v_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$$
d) Solve problems related to the equations, $PV = \frac{1}{3}Nm{v_{rms}}^2$ and pressure , $P = \frac{1}{3}\rho {v_{rms}}^2$

9.2 Molecular kinetic energy and internal energy
a) Explain and use translational kinetic energy of a molecule, $K_{tr} = \frac{3}{2}\left(\frac{R}{N_A}\right)T = \frac{3}{2}kT$
b) Define degree of freedom.
c) Identify number of degrees of freedom, f for monoatomic, diatomic and polyatomic gas molecules.
d) State the principle of equipartition of energy.
e) Discuss internal energy of gas.
f) Solve problems related to internal energy, $U = \frac{1}{2}fNkT$

9.3 First Law of Thermodynamics
a) State the First Law of Thermodynamics, $\Delta U = Q - W$
b) Solve problem related to First Law of Thermodynamics.

9.4 Thermodynamic processes
a) Define the following thermodynamic processes:
i. Isothermal;
ii. Isochoric;
iii. Isobaric and
iv. Adiabatic.
b) Analyse P-V graph for all the thermodynamic processes.

9.5 Thermodynamics work
a) Derive equation of work done in isothermal, isochoric and isobaric processes from P-V graph.
b) Solve problem related to work done in:
i. isothermal process, $W = nRT \ln\frac{V_f}{V_i} = nRT \ln\frac{P_i}{P_f}$
ii. isobaric process, $W = \int P\mathrm{d}V = P(V_f - V_i)$
iii. isochoric process, $W = \int P\mathrm{d}V = 0$

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

Panels:

No.	Panel	Institution	Academic Qualification
1.	Assoc. Professor Ts. Dr. Shahrul Kadri bin Ayop	Universiti Pendidikan Sultan Idris	PhD (Electronics for Informatics), Hokkaido MSc (Physics), Leipzig BSc (Hons) (Industrial Physics), UTM
2.	Prof. Ts. Dr. Azhan bin Hashim @ Ismail	Universiti Teknologi MARA	PhD (Material Science), UPM BSc (Hons) – Physics, UPM
3.	Dr. Ariffin bin Abas	Kolej Matrikulasi Johor	PhD(Physics), UPM MSc (Physics), UPM BSc (Hons) – Physics, UM DipEd (Physics), UM
4.	Pn. Salmah Binti Othman	Kolej Matrikulasi Melaka	BSc (Hons) – Physics, UTM DipEd (Physics), UTM
5.	En Marhalim bin Hashim	Kolej Matrikulasi Pulau Pinang	MMngtTech (HRD) UTM, BSc Ed (Hons) - Physics, UKM
6.	En Mohd Fauzi bin Abdul Zubir	Kolej Matrikulasi Sarawak	BSc (Hons) – Fizik dan Matematik, UM Diploma Pendidikan (Pengajian Fizik) MPRM
7.	Pn. Raziah binti Mohd Noor	Kolej Matrikulasi Kejuruteraan Kedah	B.EE (Hons) – Power
8.	Tn. Hj. Zahidi bin Hashim	Kolej Matrikulasi Kejuruteraan Johor	BSc with Ed. (Hons) – Physics, UTM
9.	Pn. Chong Yoke Lai	Kolej Matrikulasi Johor	BSc Comp. with Ed. (Hons) – Physics, UTM
10.	En Mohd Rohit bin Safuan	Kolej Matrikulasi Selangor	BSc Ed. (Hons) – Physics, USM
11.	Pn. Siti Aisyah binti Sahdan	Bahagian Pembangunan Kurikulum KPM	BSc. Physics (Hons), University of Nottingham, UK
12.	Pn. Aifaa binti Awang Kechik	Bahagian Matrikulasi KPM	BSc with Ed. (Hons) – Physics, UPM
13.	Pn. Jamilah binti Abdul Rashid	Bahagian Matrikulasi KPM	BEng (Hons) Electrical, Electronis & System, UKM

KEMENTERIAN PENDIDIKAN

CURRICULUM SPECIFICATIONS
PHYSICS 1 (SP015)

CONSTRUCTIVE ALIGNMENT

Course Learning Outcome (CLO)	Programme Learning Outcome (PLO)			Teaching and Learning Method	SLT			%	Assessment	SLT			%	Fixed Assessment Weightage (%)
	PLO 1	PLO 2	PLO 3		F2F	NF2F	Total			F2F	NF2F	Total		
1. Describe basic concepts of mechanics, waves, matters, heat and thermodynamics. (C2, PLO 1, MQF LOC i)	✓			Lecture	18	18	36	20	Summative Assessment Test (UPS)	1.5	4.5	6	24	20
2. Solve problems related to mechanics, waves, matters, heat and thermodynamics. (C4, PLO 2, MQF LOC ii)		✓		Tutorial	49	49	98	54	Examination	2	6	8	32	40
				Tutorial (Topic 6)	5	5	10	6	Assignment	0	3	3	12	10
				Tutorial (Pre and Post lab)	12	12	24	13	Lab Report	1	3	4	16	15
3. Apply the appropriate scientific laboratory skills in physics experiments. (P3, PLO 3, MQF LOC iii a)			✓	Practical	12	0	12	7	Practical Test	1	3	4	16	15
Overall	✓	✓	✓	Lecture Tutorial Practical	96	84	180	100	UPS Examination Assignment Practical Test Lab Report	5.5	19.5	25	100	100

Berkuat kuasa mulai Sesi 2022/2023

PANDUAN JADUAL PENENTU UJIAN PENILAIAN SUMATIF (JPUPS)

Kursus: PHYSICS 1 **Kod Kursus:** SP015

	Topic	CLO	SLT	%	No of Questions	Taxanomy Level		UPS 1	UPS 2	UPS 3
						C1	C2			
1	Physical quantities and measurements	1	2	7%	3	/	/	/		
2	Kinematics of motions	1	3	10%	5	/	/	/		
3	Dynamics of linear motion	1	3	10%	5	/	/	/		
4	Work, energy and power	1	3	10%	5	/	/		/	
5	Circular motion	1	2	7%	3	/	/		/	
6	Rotation of rigid body	1	3	10%	5	/	/		/	
7	Oscillations and waves	1	7	23%	12	/	/			/
8	Physics of matter	1	7	23%	12	/	/			/
9	Kinetic theory of gases and thermodynamics									
	TOTAL		30	100%	50			20%		

Berkuat kuasa mulai Sesi 2022/2023

SP025

CURRICULUM SPECIFICATIONS
PHYSICS 2 (SP025)

1.	Name and code of course:	Physics 2 (SP025)
2.	Synopsis:	This course is offered to students to acquire concepts in physics as well as to enhance students' manipulative skills through practical sessions.
3.	Name(s) of academic staff:	Aifaa binti Awang Kechik
4.	Semester offered:	Semester II
5.	Credit value:	5
6.	Prerequisite/ co-requisite (if any):	None
7.	Course Learning Outcomes (CLO): At the end of the course, students should be able to: 1. Explain basic concepts of electricity, magnetism, optics and modern physics. (C2, PLO 1, MQF LOC i) 2. Solve problems of electricity, magnetism, optics and modern physics. (C4, PLO 2, MQF LOC ii) 3. Apply the appropriate scientific laboratory skills in physics experiments. (P3, PLO 3, MQF LOC iii a) 4. Interpret and use familiar and uncomplicated numerical and graphical data to solve problems in physics. (C4, PLO 7, MQF LOC iii e) *Note: The **MQF 2.0 learning outcomes clusters (LOC)** are:* *i. Knowledge and understanding* *ii. Cognitive skills* *iii. Functional work skills with focus on:* *a. Practical skills* *b. Interpersonal skills* *c. Communication skills* *d. Digital skills* *e. Numeracy skills* *f. Leadership, autonomy and responsibility* *iv. Personal and entrepreneurial skills* *v. Ethics and professionalism*	

CURRICULUM SPECIFICATIONS
PHYSICS 2 (SP025)

8. Mapping of Programme Learning Outcomes (PLO) to Programme Educational Objectives (PEO)

PLO \ PEO	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
PLO 1	✓				
PLO 2		✓			
PLO 3	✓				
PLO 4			✓		
PLO 5			✓		
PLO 6				✓	
PLO 7		✓			
PLO 8					✓
PLO 9				✓	
PLO 10					✓

Programme Educational Objectives (PEO)

Upon a year of graduation from the programme, graduates are:

PEO 1 Knowledgeable and technically competent in their science disciplines in-line with higher educational institution requirement.
PEO 2 Able to apply information and use data to solve problems in science disciplines.
PEO 3 Able to communicate competently and collaborate effectively in group work to compete in higher education environment.
PEO 4 Able to use basic information technologies and engage in life-long learning to continue the acquisition of new knowledge and skills.
PEO 5 Able to demonstrate leadership skills and practice good values and ethics in managing organisations.

Programme Learning Outcomes (PLO)

At the end of the programme, students should be able to:

PLO 1 Acquire knowledge of science and mathematics as a fundamental of higher level education.
PLO 2 Apply logical, analytical and critical thinking in scientific studies and problem solving.
PLO 3 Demonstrate manipulative skills in laboratory works.
PLO 4 Collaborate in group work with skills required for higher education.
PLO 5 Deliver ideas, information, problems and solution in verbal and written communication.
PLO 6 Use basic digital technology to seek and analyse data for management of information.
PLO 7 Interpret familiar and uncomplicated numerical data to solve problems.
PLO 8 Demonstrate leadership, autonomy and responsibility in managing organization.
PLO 9 Initiate self-improvement through independent learning.
PLO 10 Practice good values, attitude, ethics and accountability in STEM and professionalism.

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9. Mapping of Course Learning Outcomes (CLO) to Programme Learning Outcomes (PLO), Teaching Methods and Assessment Methods:

CLO \ PLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	Teaching Method	Assessment Method
CLO 1	✓										Lecture	Summative Assessment Test (UPS)
CLO 2		✓									Tutorial	Examination Assignment 1 Lab Report
CLO 3			✓								Practical	Practical Test
CLO 4							✓				Tutorial	Assignment 2

(This description must be read together with Standard 2.1.2, 2.2.1 and 2.2.2 in Area 2)

10. Transferable Skills (if applicable): Critical Thinking and Problem Solving

11. Distribution of Student Learning Time (SLT):

Course Content Outline	CLO	Learning & Teaching Activities						Total SLT
		Guided Learning / e-Learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
1.0 Electrostatics 1.1 Coulomb's Law 1.2 Electric field 1.3 Electric potential 1.4 Charge in a uniform electric field	1, 2	2	6	0	0	0	8	16
2.0 Capacitors and Dielectrics 2.1 Capacitance and capacitors in series and parallel 2.2 Charging and discharging capacitors 2.3 Capacitors with dielectrics	1, 2, 3	2	6	2	0	0	8	18
3.0 Electric Current And Direct-Current Circuits 3.1 Electrical current 3.2 Ohm's Law and resistivity 3.3 Variation of resistance with temperature 3.4 Electromotive force (emf), internal resistance and potential difference 3.5 Resistors in series and parallel 3.6 Kirchhoff's Rules 3.7 Electrical energy and power 3.8 Potential divider 3.9 Potentiometer	1, 2, 3	2	12	4	0	0	14	32

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	4.0 Magnetism 4.1 Magnetic field 4.2 Resultant magnetic field produced by current-carrying conductor 4.3 Force on a moving charged particle in a uniform magnetic field 4.4 Force on a current carrying conductor in a uniform magnetic field 4.5 Forces between two parallel current-carrying conductors 4.6 Application of motion of charged particle	1, 2, 3, 4	2	8	2	0	0	10	22
	5.0 Electromagnetic Induction 5.1 Magnetic flux 5.2 Induced emf 5.3 Self-inductance 5.4 Energy stored in inductor 5.5 Mutual inductance	1, 2	2	6	0	0	0	8	16
	6.0 Alternating Current 6.1 Alternating current 6.2 Root mean square (rms) 6.3 Resistance, reactance and impedance 6.4 Power and power factor	1, 2	2	6	0	0	0	8	16
	7.0 Optics 7.1 Reflection at a spherical surface 7.2 Refraction at a spherical surface 7.3 Thin lenses 7.4 Huygen's Principle 7.5 Constructive and destructive interferences 7.6 Interference of transmitted light through double-slits 7.7 Interference of reflected light in thin films 7.8 Diffraction by a single slit 7.9 Diffraction grating	1, 2, 3	3	16	4	0	0	19	42
	8.0 Wave Properties of Particle 8.1 de Broglie wavelength 8.2 Electron diffraction	1, 2	1	2	0	0	0	3	6
	9.0 Nuclear and Particle Physics 9.1 Binding energy and mass defect 9.2 Radioactivity 9.3 Particle accelerator 9.4 Fundamental particle	1, 2	2	4	0	0	0	6	12
	Total		**18**	**66**	**12**	**0**	**0**	**84**	**180**

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	Continuous Assessment	Percentage (%)	F2F	NF2F	Total SLT
	1. Assignment (Topic 4 - CTPS)	10	0	2	2
	1. Assignment (Topic 4 - Numeracy)	5	0	1	1
	2. Practical Test	10	1	3	4
	3. Lab Report	15	1	3	4
	Final Assessment	**Percentage (%)**	**F2F**	**NF2F**	**Total SLT**
	1. Summative Assessment Test	20	1.5	4.5	6
	2. Examination	40	2	6	8
	GRAND TOTAL SLT				**205**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face-to-Face, NF2F = Non Face-to-Face

12.	Special requirement or resources:	None
13.	References:	Cutnell, J. D., Johnson, K. W., Young, D., & Stadler, S. (2019). *Introduction to Physics* (11th ed.). Hoboken, N.J: John Wiley & Sons. Serway, R. A. & Jewett, J. A. (2019). *Physics for Scientists and Engineers* (10th ed.). International Student Edition. USA: Brooks/ Cole Cengage Learning. Giancoli, D. C. (2016). *Physics – Principles with Application* (7th ed.). Prentice Hall.
14.	Other additional information:	Teaching Learning Outcomes:

Topic 1: Electrostatics

1.1 Coulomb's Law

a) State Coulomb's Law, $F = \frac{Qq}{4\pi\varepsilon_o r^2} = \frac{kQq}{r^2}$

b) Sketch the electric force diagram.

c) Apply Coulomb's Law for a system of point charges.
**simple configuration of charges with a maximum four charges in 2D*

1.2 Electric field

a) Define and use electric field strength, $\vec{E} = \frac{\vec{F}}{q_o}$

b) Use $E = \frac{kQ}{r^2}$ for point charge.

c) Sketch the electric field strength diagram.
* simple configuration of charges with a maximum four charges in 2D

d) Determine the electric field strength E for a system of charges.
** simple configuration of charges with a maximum four charges in* 2D

CURRICULUM SPECIFICATIONS
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1.3 Electric potential

a) Define electric potential, $V = \frac{W}{q_o}$

b) Define and sketch equipotential lines and surfaces of:
   i. an isolated charge; and
   ii. a uniform electric field.

c) Use $V = \frac{kQ}{r}$ for a point charge and a system of charges.
   ** simple configuration of charges with a maximum four charges in 2D*

d) Apply potential difference between two points: $\Delta V = V_{final} - V_{initial}$, $\Delta V = \frac{W}{q_o}$

e) Apply the change in potential energy between two points in electric field: $\Delta U = q\Delta V$

f) Apply potential energy of a system of point charges: $U = k\left(\frac{q_1 q_2}{r_{12}} + \frac{q_1 q_3}{r_{13}} + \frac{q_2 q_3}{r_{23}}\right)$ up to maximum three charges.

1.4 Charge in a uniform electric field

a) Analyse the motion of a charge qualitatively and quantitatively in a uniform electric field for each of the following case,
   i. stationary charge;
   ii. charge moving perpendicularly to the field;
   iii. charge moving parallel to the field; and
   iv. charge in dynamic equilibrium.

b) Use $E = \frac{\Delta V}{d}$ for uniform electric field.

Topic 2: Capacitors and Dielectrics

2.1 Capacitance and capacitors in series and parallel

a) Define and use capacitance, $C = \frac{Q}{V}$

b) Determine the effective capacitance of capacitors in series: $\frac{1}{C_{\text{effective}}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n}$ and in parallel: $C_{\text{effective}} = C_1 + C_2 + \cdots + C_n$

c) Apply energy stored in a capacitor, $U = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C}$

2.2 Charging and discharging of capacitors

a) State physical meaning of time constant and use $\tau = RC$

b) Sketch and explain the characteristics of *Q-t* and *I-t* graph for charging and discharging of a capacitor.

c) Use:
   i. $Q = Q_o e^{\frac{-t}{RC}}$ for discharging; and
   ii. $Q = Q_o\left(1 - e^{\frac{-t}{RC}}\right)$ for charging.

d) Determine the time constant of an RC circuit.
   (Experiment 1: Capacitor)

e) Determine the capacitance of a capacitor using an RC circuit.
   (Experiment 1: Capacitor)

2.3 Capacitors with dielectrics

a) Define and use dielectric constant, $\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$

b) Describe the effects of dielectric on a parallel plate capacitor.

c) Apply capacitance of air-filled parallel plate capacitor, $C_o = \frac{\varepsilon_o A}{d}$

d) Determine capacitance with dielectric, $C = \varepsilon_r C_o$

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Topic 3: Electric Current and Direct-Current Circuits

3.1 Electrical current
a) Describe microscopic model of current.
**emphasise on the flow of free electrons in a metal. Include concept of drift velocity.*
b) Define electric current, $I = \frac{dQ}{dt}$
c) Use electric current, $I = \frac{dQ}{dt}$, $Q = ne$

3.2 Ohm's Law and resistivity
a) State and use Ohm's Law.
b) Define and use resistivity, $\rho = \frac{RA}{l}$
c) Sketch V-I graph.
(Experiment 2: Ohm's Law)
d) Verify Ohm's Law.
(Experiment 2: Ohm's Law)
e) Determine effective resistance of resistors in series and parallel by graphing method.
(Experiment 2: Ohm's Law)

3.3 Variation of resistance with temperature
a) Explain the effect of temperature on electrical resistance in metals.
b) Use $R = R_o[1 + \alpha(T - T_o)]$
* α *is at temperature* 20°C

3.4 Electromotive force (emf), internal resistance and potential difference
a) Define emf, ε and internal resistance, r of a battery.
b) State factors that influence the internal resistance.
c) Explain the relationship between emf of a battery and potential difference across the battery terminals.
d) Use terminal voltage, $V = \varepsilon - Ir$

3.5 Resistors in series and parallel
a) Determine the effective resistance of resistors in series and parallel.

3.6 Kirchhoff's Rules
a) State and apply Kirchhoff's Rules.
**maximum two closed circuit loops*
***use calculator to solve the simultaneous equations*

3.7 Electrical energy and power
a) Use power, $P = IV$, $P = I^2R$ and $P = \frac{V^2}{R}$ (known as power loss).
b) Use electrical energy, $W = IVt$

3.8 Potential divider
a) Explain principle of potential divider.
b) Use equation of potential divider, $V_1 = \left(\frac{R_1}{R_1+R_2+\cdots+R_n}\right)V$
**maximum three resistors*

3.9 Potentiometer
- a) Explain principles of potentiometer and its applications.
- b) Use related equations for potentiometer, $\frac{\varepsilon_1}{\varepsilon_2} = \frac{l_1}{l_2}$
- c) Determine internal resistance, r of a dry cell by using potentiometer. (Experiment 3: Potentiometer)

Topic 4: Magnetism

4.1 Magnetic field
- a) Define magnetic field.
- b) Identify magnetic field sources.
  **e.g: Bar magnet & current-carrying conductor (straight wire, circular coil, and solenoid), Earth magnetic field*
- c) Sketch magnetic field lines for:
  - i. bar magnet and current-carrying conductor (straight wire, circular coil, and solenoid); and
  - ii. Earth magnetic field.
- d) Determine the value of the horizontal component of the earth magnetic field, $\vec{B}_E$. (Experiment 4: Magnetic Field)

4.2 Resultant magnetic field produced by current-carrying conductor
- a) Sketch and determine resultant magnetic field diagram at a point
  **limited to two current carrying straight wires and* 2D
- b) Determine direction of $\vec{B}$ by using right hand rule.
- c) Determine the magnitude of magnetic field by using:
  - i. $B = \frac{\mu_o I}{2\pi r}$ for a long straight wire;
  - ii. $B = \frac{\mu_o I}{2r}$ at the centre of a circular coil;
  - iii. $B = \mu_o n I$ at the centre of a solenoid; and
  - iv. $B = \frac{1}{2}\mu_o n I$ at the end of a solenoid.

4.3 Force on a moving charged particle in a uniform magnetic field
- a) Explain and use magnetic force, $\vec{F} = q\vec{v} \times \vec{B}$
- b) Determine the direction of force.
- c) Describe circular motion of a charge in a uniform magnetic field.
- d) Use relationship of magnetic force, $F_B = F_c$

4.4 Force on a current carrying conductor in a uniform magnetic field
- a) Explain and use magnetic force, $\vec{F} = I\vec{l} \times \vec{B}$
- b) Determine the direction of force

4.5 Forces between two parallel current-carrying conductors
- a) Explain magnetic force per unit length of two parallel current-carrying conductors.
- b) Apply magnetic force per unit length, $\frac{F}{l} = \frac{\mu_o I_1 I_2}{2\pi d}$

4.6 Application of motion of charged particle
- a) Explain the motion of a moving charged particle in magnetic field and electric field for v, B and E perpendicular to each other.
- b) Use velocity, $v = \frac{E}{B}$ in a velocity selector.
  **e.g: Bainbridge mass spectrometer*

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Topic 5: Electromagnetic Induction

5.1 Magnetic flux
- a) Define and use magnetic flux, $\emptyset = \vec{B} \bullet \vec{A} = BA\cos\theta$
- b) Use magnetic flux linkage, $\Phi = N\emptyset$

5.2 Induced emf
- a) Explain induced emf by using Faraday's experiment.
- b) State and use Faraday's Law, $\varepsilon = -\frac{d\emptyset}{dt}$
- c) State and use Lenz's Law to determine the direction of induced current.
- d) Apply induced emf in:
  - i. a straight conductor, $\varepsilon = Blv\sin\theta$
  - ii. a coil, $\varepsilon = -NA\frac{dB}{dt}$, $\varepsilon = -NA\frac{dA}{dt}$
  - iii. a rotating coil, $\varepsilon = NAB\omega\sin\omega t$

5.3 Self-inductance
- a) Define self-inductance.
- b) Apply self-inductance, $L = -\frac{\varepsilon}{\left(\frac{dI}{dt}\right)}$ for coil and solenoid, where:
  - i. $L = \frac{N\emptyset}{I}$
  - ii. $L_{\text{coil}} = \frac{\mu_o N^2 A}{2r}$
  - iii. $L_{\text{solenoid}} = \frac{\mu_o N^2 A}{l}$

5.4 Energy stored in inductor
- a) Apply the energy stored in an inductor, $U = \frac{1}{2}LI^2$

5.5 Mutual inductance
- a) Define mutual inductance.
- b) Use mutual inductance, $M = \frac{\mu_o N_1 N_2 A}{l}$ between two coaxial solenoids.

Topic 6: Alternating Current

6.1 Alternating current
- a) Define alternating current (AC).
- b) Sketch and interpret sinusoidal AC waveform.
- c) Use sinusoidal voltage and current equations:
  - i. $V = V_o\sin\omega t$
  - ii. $I = I_o\sin\omega t$

6.2 Root mean square (rms)
- a) Define root mean square (rms) current and voltage for AC source.
- b) Use $I_{rms} = \frac{I_o}{\sqrt{2}}$, $V_{rms} = \frac{V_o}{\sqrt{2}}$

6.3 Resistance, reactance and impedance
- a) Sketch and use phasor diagram and sinusoidal waveform to show the phase relationship between current and voltage for a single component circuit of:
  - i. resistor, R
  - ii. capacitor, C
  - iii. inductor, L

b) Use phasor diagram to analyse voltage, current, and impedance of series circuit of *RL*, *RC* and *RLC*.
c) Define and use:
   i. capacitive reactance, $X_C = \frac{1}{2\pi fC}$
   ii. inductive reactance, $X_L = 2\pi fL$
   iii. impedance, $Z = \sqrt{R^2 + (X_L - X_C)^2}$
   iv. phase angle, $\emptyset = \tan^{-1}\frac{(X_L - X_C)}{R}$
d) Explain graphically the dependence of *R*, X_C, X_L and *Z* on *f* and relate it to resonance.

6.4 Power and power factor
a) Apply in AC circuit consisting of *R*, *RC*, *RL* and *RLC* in series:
   i. average power, $P_{\text{av}} = I_{rms}V_{rms}\cos\emptyset$
      **also known as power loss that only occurs in resistor*
   ii. instantaneous power, $P = IV$
   iii. power factor, $\cos\emptyset = \frac{P_r}{P_a} = \frac{P_{\text{av}}}{I_{rms}V_{rms}}$

Topic 7: Optics

7.1 Reflection at a spherical surface
a) State radius of curvature, $R = 2f$ for spherical mirror.
b) Sketch ray diagrams with a minimum of two rays to determine the characteristics of image formed by spherical mirrors.
c) Use mirror equation, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ for real object only.
   **sign convention for focal length, f and radius of curvature, R:*
   i. positive f and R for concave mirror; and
   ii. negative f and R for convex mirror
d) Apply magnification, $M = \frac{h_i}{h_o} = -\frac{v}{u}$

7.2 Refraction at a spherical surface
a) Use $\frac{n_1}{u} + \frac{n_2}{v} = \frac{n_2 - n_1}{R}$ for spherical surface.
   **sign convention for radius of curvature*, R:
   i. *positive R for convex surface; and*
   ii. *negative R for concave surface*

7.3 Thin lenses
a) Use thin lens equation, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ for real object only.
   **sign convention for focal length, f:*
   i. *positive f for convex lens; and*
   ii. *negative f for concave lens*
b) Determine the focal length of a convex lens.
   (Experiment 5: Geometrical Optics)
c) Use lens maker's equation, $\frac{1}{f} = \left(\frac{n_{\text{material}}}{n_{\text{medium}}} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$
d) Apply magnification, $M = \frac{h_i}{h_o} = -\frac{v}{u}$.
e) Use the thin lens formula for a combination of two convex lenses

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7.4 Huygens's Principle

a) State Huygens's Principle (e.g. spherical and plane wave fronts).
b) Sketch and explain the wave front of light after passing through a single slit and obstacle using Huygens's Principle.

7.5 Constructive and destructive interferences

a) Define coherence.
b) State the conditions for interference of light.
c) State the conditions of constructive and destructive interference for in phase and antiphase sources.
**emphasise on the path difference and its equivalence to phase difference*

7.6 Interference of transmitted light through double-slits

a) Use:
i. $y_m = \frac{m\lambda D}{d}$ for bright fringes (maxima); and
ii. $y_m = \frac{\left(m+\frac{1}{2}\right)\lambda D}{d}$ for dark fringes (minima), where $m = 0, \pm1, \pm2, \pm3, \ldots$.
**bright fringes: m = 0, central or 0th order max, m = 1, first bright or 1st order max*
**dark fringes: m = 0, first dark or 0th order min, m = 1, 2nd dark or 1st order min*
b) Use $\Delta y = \frac{\lambda D}{d}$ and explain the effect of changing any of the variables.
**Δy: separation between two consecutive dark or bright fringes*

7.7 Interference of reflected light in thin films

a) Identify the occurrence of phase change upon reflection.
**from lower to higher refractive index, phase change = π rad or path difference = ½ λ*
b) Describe with the aid of a diagram the interference of light in thin films at normal incidence.
**limited to three media*
c) Use the following equations for reflected light with no phase difference (non-reflective coating):
i. Constructive interference: $2nt = m\lambda$
ii. Destructive interference: $2nt = \left(m + \frac{1}{2}\right)\lambda$
d) Use the following equations for reflected light of phase difference π rad (reflective coating):
i. Constructive interference: $2nt = \left(m + \frac{1}{2}\right)\lambda$
ii. Destructive interference, $2nt = m\lambda$, where $m = 0, \pm1, \pm2, \pm3, \ldots$
e) Explain the application of thin films.
**e.g: solar panel, glass tint*

7.8 Diffraction by a single slit

a) Define diffraction.
b) Explain the diffraction of a single slit with the aid of a diagram.
c) Use:
i. $y_m = \frac{m\lambda D}{a}$ for dark fringes (minima)
ii. $y_m = \frac{\left(m+\frac{1}{2}\right)\lambda D}{a}$ for bright fringes (maxima), where $m = \pm1, \pm2, \pm3, \ldots$
**dark fringes: m = 1, 1st dark or 1st order min, m = 2, 2nd dark or 2nd order min*
bright fringes: m = 1, 1st bright or 1st order max, m = 2, 2nd bright or 2nd order max
central bright: Use equation for first dark

7.9 Diffraction grating

a) Explain the formation of diffraction with the aid of a diagram.
b) Apply $d \sin\theta = m\lambda$ where $d = \frac{1}{N}$
**e.g.: transparent compact disc, muslin cloth, etc.).*
***bright fringes: m = 0, central or 0th order max, m = 1, first bright or 1st order max*
N: number of slits per unit length
c) Determine the wavelength of laser beam using a diffraction grating.
(Experiment 6: Diffraction Grating)
d) Determine the number of diffraction grating lines per unit length.
(Experiment 6: Diffraction Grating)

Topic 8: Wave Properties of Particle

8.1 de Broglie wavelength
a) State wave-particle duality.
b) Use de Broglie wavelength, $\lambda = \frac{h}{p}$

8.2 Electron diffraction
a) Describe the observations of electron diffraction in Davisson-Germer experiment.
b) Explain the wave behaviour of electron in an electron microscope.
**relate de Broglie wavelength of electron with the resolving power of the microscope*
c) State the advantages of electron microscope compared to optical microscope.

Topic 9: Nuclear and Particle Physics

9.1 Binding energy and mass defect
a) Define and use mass defect, $\Delta m = (Zm_p + Nm_n) - m_{\text{nucleus}}$
b) Define and use binding energy, $E_B = \Delta mc^2$
c) Determine binding energy per nucleon, $\frac{E_B}{A}$
d) Sketch and describe graph of binding energy per nucleon against nucleon number.

9.2 Radioactivity

a) Explain α, $\beta+$, β^- and γ decays.
**radioactive decay as spontaneous and random process*
***introduce neutrino and antineutrino*
b) State and use decay law $\frac{dN}{dt} = -\lambda N$
c) Define and determine activity, A and decay constant, λ.
**consider decay curve*
d) Use $N = N_o e^{-\lambda t}$ or $A = A_o e^{-\lambda t}$
e) Define and use half-life, $T_{\frac{1}{2}} = \frac{\ln 2}{\lambda}$

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9.3 Particle Accelerator
a) State the thermionic emission.
b) Explain the acceleration of particle by electric and magnetic field.
c) State the role of electric and magnetic field in particle accelerators (linac and cyclotron) and detectors (general principles of ionisation and deflection only).
d) State the need of high energies required to investigate the structure of nucleon.

9.4 Fundamental Particle
a) Explain the standard quark-lepton model particles (baryons, meson, leptons and hadrons).
b) Explain the corresponding antiparticle for every particle.

CURRICULUM SPECIFICATIONS
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Panels:

No.	Panel	Institution	Academic Qualification
1.	Assoc. Professor Dr. Rosnah binti Zakaria	Universiti Teknologi MARA	PhD (Material Science), UiTM MScEd (Physics), UKM B. Sc. Ed (Hons) – Physics UKM
2.	Assoc. Professor Ir. Dr Sohiful Anuar bin Zainol Murad	Universiti Malaysia Perlis	PhD (Electronics), Kyushu Univ, Japan MSc (Electronic System Design), USM B.Eng (Electronic), Saga Univ, Japan
3.	En Mohamed Hazri bin Ariffin	Kolej Matrikulasi Kelantan	BScEd (Hons) (Physics), UTM
4.	Pn. Hayati binti Ibrahim	Kolej Matrikulasi Pahang	MEd (Physics), UPSI BSc Edu (Hons) – Physics, UM
5.	En. Nazaruddin bin Zakaria	Kolej Matrikulasi Labuan	MEd (Education Management), UMS BSc with Edu (Physics), UPM
6.	En. Che Mohamad Zamri bin Bakar	Kolej Matrikulasi Perak	BSc (Hons) (Physics), UKM DipEd (Physics), UTM
7.	Pn. Salasiah Binti Hamzah	Kolej Matrikulasi Kejuruteraan Johor	BSc (Physics), UTM DipEd (Physics), MPRM
8.	Pn. Nor Asyiqin Binti Mohd Baharuddin	Kolej Matrikulasi Perlis	BSc (Physics), USM DipEd, MPPPP
9.	En. Elmy bin Abdul Malek	Kolej Matrikulasi Kejuruteraan Pahang	BSc (Hons) (Physics), USM DipEd (Physics), IPGKDRI
10.	Pn. Hasimah binti Husin	Kolej Matrikulasi Kedah	BEng (Kejuruteraan Elektrik & Elektronik), USM DipEd (Physics), MPRM
11.	Pn. Aifaa binti Awang Kechik	Bahagian Matrikulasi KPM	BSc with Edu (Hons) – Physics, UPM
12.	Pn. Jamilah binti Abdul Rashid	Bahagian Matrikulasi KPM	BEng (Hons) Electrical, Electronis & System, UKM
13.	Pn. Siti Aisyah binti Sahdan	Bahagian Pembangunan Kurikulum KPM	BSc. Physics (Hons), University of Nottingham, UK

BAHAGIAN MATRIKULASI * KEMENTERIAN PENDIDIKAN MALAYSIA *

KEMENTERIAN PENDIDIKAN

CURRICULUM SPECIFICATIONS
PHYSICS 2 (SP025)

CONSTRUCTIVE ALIGNMENT

Course Learning Outcome (CLO)	PLO				Teaching and Learning Method	SLT			%	Assessment	SLT			%	Fixed Assessment Weightage (%)
	PLO 1	PLO 2	PLO 3	PLO 7		F2F	NF2F	Total			F2F	NF2F	Total		
1. Explain basic concepts of electricity, magnetism, optics and modern physics. (C2, PLO 1, MQF LOC i)	✓				Lecture	18	18	36	20	Summative Assessment Test (UPS)	1.5	4.5	6	24	20
2. Solve problems of electricity, magnetism, optics and modern physics. (C4, PLO 2, MQF LOC ii)		✓			Tutorial	46	46	92	51	Examination	2	6	8	32	40
					Tutorial (Topic 4)	8	8	16	9	Assignment (CTPS)	0	2	2	8	10
					Tutorial (Pre & Post Lab)	12	12	24	13	Lab Report	1	3	4	16	15
3. Apply the appropriate scientific laboratory skills in physics experiments. (P3, PLO 3, MQF LOC iii a)			✓		Practical	12	0	12	7	Practical Test	1	3	4	16	10
4. Interpret and use familiar and uncomplicated numerical and graphical data to solve problems of in physics. (C4, PLO 7, MQF LOC iii e)				✓	Tutorial (Topic 4)					Assignment (Numeracy)	0	1	1	4	5
Overall	✓	✓	✓	✓	Lecture Tutorial Practical	96	84	180	100	UPS Examination Assignment Practical Test Lab Report	5.5	19.5	25	100	100

Berkuat kuasa mulai Sesi 2022/2023

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PANDUAN JADUAL PENENTU UJIAN PENILAIAN SUMATIF (JPUPS)

Kursus: PHYSICS 2 **Kod Kursus: SP025**

	Topic	CLO	SLT	%	No of Questions	Taxanomy Level		UPS 1	UPS 2	UPS 3
						C1	C2			
1	Electrostatics	1	4	13%	6	/	/	/		
2	Capacitor and Dielectrics	1	4	13%	7	/	/	/		
3	Electric Current And Direct-Current Circuits	1	4	13%	7	/	/	/		
4	Magnetism	1	4	13%	6	/	/		/	
5	Electromagnetic Induction	1	4	13%	7	/	/		/	
6	Alternating Current	1	4	13%	7	/	/		/	
7	Optics	1	6	20%	10	/	/			/
8	Wave Properties of Particle									
9	Nuclear and Particle Physics									
	TOTAL		30	100%	50			20%		

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