COURSE OUTLINE: CSEC PHYSICS

(GENERAL) 2020/2021

Waves & Optics

Course Description:

Physics is the study of the nature and properties of matter and energy. It seeks to explain the correlation of all properties of matter and how they sustain life and allow things to operate as they do. In Physics, everything that you will study will include energy; without energy nothing would happen or work. Waves is an aspect of Physics that we seek to understand because it can be used to explain many phenomena in the physical world. Waves are everywhere, it is all around us; it is present in earthquakes, water waves, visible light, stadium waves, sine and cosine waves, waves on a string, a slinky and even when you speak. In this course you will be exposed to light waves, sound waves, water waves, earthquake waves among others. You will be able to experience and see several types of waves first hand and will be shown how to apply Mathematics to your experiences in order to quantify the various qualities of waves that you will be exposed to. You will also come to learn and understand the importance of waves in the medical field, construction (especially in countries prone to earthquake such as Japan) and manufacturing industry (such as the manufacturing of land, sea and air vessels).

Prepared by Mr. K. Rhoomes (H.O.D for the Dpt. of Mathematics and Natural Sciences)
Gaynstead High School

General Objectives:

On completion of this Section, students should:

1. Appreciate that wave motion is a means of transferring energy and that there are certain features common to all waves.
2. Understand the way in which sound waves are produced and propagated.
3. Understand the properties of the electromagnetic spectrum.
4. Be familiar with the historical development of the theory of light.
5. Appreciate how a ray treatment facilitates the understanding of reflection and refraction of light waves.

Assessment Weighting:

Classwork: **25%**

Tests: **15%**

Exam: **45%**

Attendance: **5% (absent for 50% of classes = 0%)**

Punctuality: **5% (late for more than 50% of classes = 0%)**

Participation: **5% (participate in less than 50% of classes = 0%)**

Learning Outcomes:

Upon completion of this section students should be able to:

1. Differentiate between types of waves.
2. Apply speed, frequency, wavelength, period and amplitude formulae to describe waves.
3. Represent transverse and longitudinal waves in displacement-position and displacement-time graphs.
4. Describe how sound is produced and propagated in a medium.
5. Relate the terms 'pitch' and 'loudness' to wave parameters.
6. Apply the speed of sound to practical situations.
7. Cite evidence that sound waves reflect, diffract and interfere.
8. Describe the use of ultrasound.
9. State the properties of electromagnetic waves.
10. Differentiate between types of e.m. waves in terms of their wavelengths.
11. Identify a source and use of each type of e.m. wave.
12. Compare the rival theories of light held by scientists (Wave Particle Duality)
13. Conduct a Young's double slit experiment to show that light is a wave.
14. Explain why the diffraction of light is not normally observed.
15. Apply the principle that light travels in a straight line.
16. Describe the formation of images in a plain mirror.
17. Gives examples of observations which indicate that light can be refracted.
18. Describe the refraction of light rays.
19. Describe how a prism may be used to produce a spectrum.

20. Apply Snell's law
21. Explain 'critical angle' and 'total internal reflection'.
22. Relate critical angle to total internal reflection
23. Draw diagrams illustrating applications of total internal reflection.
24. Illustrate the effect of converging and diverging lenses on a beam of parallel rays.
25. Define the terms: principal axis, principal focus, focal length, focal plane and magnification.
26. Differentiate between real and virtual images.
27. Apply the equations for magnification.
28. Determine the focal length of a converging lens.

Course Details

Date	Topic	Specific Objectives	Assignments	Resources
Week One October	Wave Motion: Types of Waves and waves parameters	Differentiate between types of waves. Apply speed, frequency, wavelength and amplitude formulae	Drop a pebble in a container of water and describe the type of wave(s) produced. Explain the production of the wave and how the energy is transported in the wave. Does the particles move parallel to the propagation of the wave of perpendicular?	Container of water and pebble. Reading: pages 83 – 84 of Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text) Difference between transverse and longitudinal waves: https://www.youtube.com/watch?v=0Anh9HthWgQ
Week two of October	Wave Motion: Wave parameters cont.	Represent transverse and longitudinal waves in displacement-position and displacement-time graphs.	CSEC Physics Workbook Pages 49 – 51. Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London (Student's workbook)	Reading: pages 85 – 89 Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text)
Week three of October	Sound: Production and Propagation, Speed of sound	Describe how sound is produced and propagated in a medium. Relate the terms 'pitch' and 'loudness' to wave parameters.	Page 96 of Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London questions 1 - 6 Homework: Pages 52 – 53 (Questions 1 and 2)	Pages 91 – 93 of Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text)

		Apply the speed of sound to practical situations.		
Week four of October	Speed of sound cont.	Cite evidence that sound waves reflect, refract, diffract and interfere. Describe the use of ultrasound.	Classwork: pages 53 – 54 of CSEC Physics Workbook Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London (Student's workbook)	Interference: https://www.youtube.com/watch?v=D7aftTF--5w Refraction of sound waves: https://www.youtube.com/watch?v=ZgwEAUHpNrs
Week one of November	Electromagnetic waves	State the properties of e.m. waves. Differentiate between types of e.m. waves in terms of their wavelengths; Identify a source and use of each type of e.m. wave.	Classwork: Page 55 of CSEC Physics Workbook. Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London (Student's workbook)	Pages 97 – 99 of Concise: Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text)
Week two of November	Light Waves: Wave Duality & Young's Double Slit Experiment **6 Weeks Test**	Compare the rival theories of light held by scientists. **Objectives from Wk 1 of October – Wk 1 of November**	Research project: *Research the theories of Huygens, Newton, Young, and Einstein, and discuss the twentieth century experiments that provided evidence that light has both a particle and a wave nature. Must explain what a 'wave' and a 'particle' is.*	Students will be required to research using the internet. Readings can also be taken from pages 100 – 104 of Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text)
Week 3 of November	Light Rays	Explain why the diffraction of light is not normally observed. apply the principle that light travels in straight lines – the pinhole camera	Pages 56 – 57 of Concise Physics Workbook. Knowledge of wave duality and Young's Double Slit Experiment needed.	https://www.youtube.com/watch?v=jhBC39xZVnw

Week four of November	Reflection	Apply the laws of reflection. Describe the formation of images in a plane mirror	Reflection Lab	Glass block/perspex, pins, blank paper, pencil, ruler, protractor
Week 1 of December	Refraction	Give examples of observations which indicate that light can be refracted; Describe the refraction of light rays; Describe how a prism may be used to produce a spectrum. Apply Snell's Law	Refraction Lab	Glass block/perspex, pins, blank paper, pencil, ruler, protractor https://micro.magnet.fsu.edu/optics/activities/students/prisms.html
Week two of December	Critical Angle and Total Internal Reflection	Explain 'critical angle' and 'total internal reflection'. Relate critical angles to total internal reflection. Draw diagrams illustrating applications of total internal reflection.	Design and create a periscope (must include a video of the construction as well as a video of showing how thing appear while looking through the periscope). Classwork: Pages 59 Question 5 and 61 – 62 of Concise Physics Workbook Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London (Student's workbook)	https://www.youtube.com/watch?v=Bnjn5e4LTmE Students are expected to be creative and use materials in their surroundings or purchase items from a hardware/industrial store.
Week three of December	Lenses: Action of Lenses	Illustrate the effect of converging and diverging lenses on a beam of parallel rays.	Write a report on the effect of converging and diverging lenses on a beam of parallel rays	VP lab (Virtual Physics Laboratory) Simulation – Project and laptop/internet

		Define the terms: 1. principal axis 2. principal focus 3. focal length 4. focal plane 5. magnification With use of a diagram	based on the observations made from the Virtual Physics Laboratory.	connection for Google Meets/Zooming
Week four of December	**Christmas Break**	**Christmas Break**	**Christmas Break**	**Christmas Break**
Week One of January	Image Formation	Differentiate between real and virtual images. Apply the equations for magnification. Determine the focal length of a converging lens.	Pages 63 – 64 CSEC Physics Workbook Terry, D. (2015).*CSEC physics workbook (1st ed.)*. HarperCollins. London (Student's workbook)	Pages 118 – 123 of Revision Course: CSEC Physics: DeFreitas, P. (2016). *Concise revision course: CSEC physics (1st ed.)*. HarperCollins. London (Students' Text)
Week two of January	Labs	Reflection, Refraction, Heat Capacity		
Week three of January	Revision for Exams	ALL OBJECTI VES		
Week four of January	**EXAMS**	**EXAMS**	**EXAMS**	**EXAMS**