TALENTA ACADEMY

OUTLINE OF COURSE OF STUDY

Course Title/Grade/Type: Physics, Grade 12, University Preparation

Ministry Course Code: SPH4U

Credit Value: *1.0*

Department: Science

Department Head: Mr. Kunasingam

Course Developed by & Date: Mr. Mahalingam, Mr. Kunasingam June 2017

Course Revised by & Date: Mr. Kunasingam, June 2018

Prerequisite: Physics**,** Grade 11, SPH3U, University Preparation

Policy Document: *The Ontario Curriculum, Grades 11 and 12, Science, Revised 2008.*

Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010

Course Description:

This course enables students to deepen their understanding of physics concepts and theories. Students will continue their exploration of energy transformations and the forces that affect motion, and will investigate electrical, gravitational, and magnetic fields and electromagnetic radiation. Students will also explore the wave nature of light, quantum mechanics, and special relativity. They will further develop their scientific investigation skills, learning, for example, how to analyse, qualitatively and quantitatively, data related to a variety of physics concepts and principles. Students will also consider the impact of technological applications of physics on society and the.

OVERALL CURRICULUM EXPECTATIONS

A. Scientific Investigation Skills and Career Exploration

By the end of this course, students will:

1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);
2. identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.

B. Dynamics

By the end of this course, students will:

1. analyse technological devices that apply the principles of the dynamics of motion, and assess the technologies' social and environmental impact;
2. investigate, in qualitative and quantitative terms, forces involved in uniform circular motion and motion in a plane, and solve related problems;
3. demonstrate an understanding of the forces involved in uniform circular motion and motion in a plane.

C. Energy and Momentum

By the end of this course, students will:

1. analyse, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures;
2. investigate, in qualitative and quantitative terms, through laboratory inquiry or computer simulation, the relationship between the laws of conservation of energy and conservation of momentum, and solve related problems;
3. demonstrate an understanding of work, energy, momentum, and the laws of conservation of energy and conservation of momentum, in one and two dimensions.

D. Gravitational, Electric, and Magnetic Fields

By the end of this course, students will:

1. analyse the operation of technologies that use gravitational, electric, or magnetic fields, and assess the technologies' social and environmental impact;
2. investigate, in qualitative and quantitative terms, gravitational, electric, and magnetic fields, and solve related problems;
3. demonstrate an understanding of the concepts, properties, principles, and laws related to gravitational, electric, and magnetic fields and their interactions with matter.

E. The Wave Nature of Light

By the end of this course, students will:

1. analyse technologies that use the wave nature of light, and assess their impact on society and the environment;
2. investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems;
3. demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization.

F. Revolutions in Modern Physics: Quantum Mechanics and Special Relativity

By the end of this course, students will:

1. analyse, with reference to quantum mechanics and relativity, how the introduction of new conceptual models and theories can influence and/or change scientific thought and lead to the development of new technologies;
2. investigate special relativity and quantum mechanics, and solve related problems;
3. demonstrate an understanding of the evidence that supports the basic concepts of quantum mechanics and Einstein's theory of special relativity.

OUTLINE OF COURSE CONTENT

UNITS	TITLES	TIME
Unit 1	Dynamics	27 hours
Unit 2	Energy and Momentum	22 hours
Unit 3	Electric, Gravitational, and Magnetic Fields	20 hours
Unit 4	The Wave Nature of Light	20 hours
Unit 5	Revolutions in Modern Physics: Quantum Mechanics and Special Relativity	15 hours
	Final Assessment	6 hours
	Total Hours	**110 hours**

TEACHING AND LEARNING STRATEGIES

Teachers will bring enthusiasm and varied teaching and assessment approaches to the classroom, addressing individual students' needs and ensuring sound learning opportunities for every student. The activities offered should enable students to relate and apply these concepts to the social, environmental, and economical conditions and concerns of the world in which they live. Opportunities to relate knowledge and skills to these wider contexts will motivate students to learn in a meaningful way and to become life-long learners.

Teachers will help students understand that problem solving of any kind often requires a considerable expenditure of time and energy and a good deal of perseverance. Teachers also will encourage students to investigate, to reason, to explore alternative solutions and to take the risks necessary to become successful problem solvers.

Effective instructional approaches and learning activities draw on students' prior knowledge, capture

their interest, and encourage meaningful practice both inside and outside the classroom. Students will be engaged when they are able to see the connection between the scientific concepts they are learning and their application in the world around them and in real-life situations.

Due to its importance, students will have opportunities to learn in a variety of ways- individually, cooperatively, independently, with teacher direction, through hands-on experiences, and through examples followed by practice. The approaches and strategies teachers use will vary according to both the object of the learning and the needs of the students. Teachers will accomplish this in a classroom and online environment with the use of: virtual labs, online simulations, animations, videos, and other interactive objects.

Since the over-riding aim of this course is to help students relating science to technology, society, and the environment; developing skills of investigation and communication; and understanding basic concepts of physics, the following strategies will be implemented throughout the course:

- Class work with checklist
- Think Pair Share
- Direct Instruction
- Investigation
- Case studies
- Demonstration
- Small Group activities
- Teacher-lead discussion
- Mind mapping
- Open Ended Questions
- Whole Class Discussion
- Guided exploration
- Problem Solving
- Peer and self assessment
- Predict – Observe –Explain Strategy
- Independent study/Research
- Brainstorming
- Discussion Group
- Electronic simulation activities

ASSESSMENT AND EVALUATION STRATEGIES

Assessment for and *Assessment as* Learning Strategies

Assessment of the learning skills will be done on an ongoing basis throughout the academic year by observations of students at work, checklists and interviews. A variety of assessment strategies to address students' needs will be used during the school year.

Assessment of or Evaluation Strategies:

Evaluation will be implemented at or near the end of a period of learning, and may be used to inform further instruction. It is mainly used by the teacher to summarize learning at a given point in time. This summary is used to make judgements about the quality of student learning on the basis of established criteria, to assign a value to represent that quality, and to support the communication of information about achievement to students themselves, parents, teachers, and others.

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for the discipline.

The tools highlighted will be used for the three different types of assessments:

Assessment as Learning	Assessment for Learning	Assessment of Learning
Student Product ☐ Journals/Letters/Emails (checklist) ☐ Learning Logs (anecdotal) ☐ Entrance tickets ☐ Exit tickets ☐ Homework(checklist) ☐ Completed work(checklist)	**Student Product** ☐ Assignment ☐ Journals/Letters/Emails (checklist) ☐ Pre-tests (scale/rubric) ☐ Quizzes (scale/rubric) ☐ Rough drafts (rubric) ☐ Portfolios (rubric) ☐ Posters (rubric/scale) ☐ Graphic organizers (scale) ☐ Peer feedback (anecdotal/checklist) ☐ Reports (rubric) ☐ Essays (rubric) ☐ Webbing/Mapping (rubric/scale) ☐ Entrance ticket ☐ Vocabulary notebooks (anecdotal) ☐ Visual Thinking Networks (rubric)	**Student Product** ☐ Assignment ☐ Journals/Letters/Emails (checklist) ☐ Tests (scale/rubric) ☐ Unit Tests ☐ Exam ☐ Rough drafts (rubric) ☐ Portfolio (rubric) ☐ Posters (rubric/scale) ☐ Graphic organizers (scale) ☐ Reports (rubric) ☐ Essays (rubric) ☐ Visual Thinking Networks (rubric) ☐ ISU (scale/rubric) ☐ Investigation Lab report (scale/rubrics) ☐ Case Study (rubrics) ☐ Problem Solving Activities
Observation ☐ Whole class discussions (anecdotal) ☐ Self-proofreading (checklist) ☐ Interviews (checklist) ☐ Seeking assistance	**Observation** ☐ Class discussions (anecdotal) ☐ Debate (rubric) ☐ PowerPoint presentations (rubric) ☐ Performance tasks (anecdotal/scale) ☐ In Class work (checklist)	**Observation** ☐ Debate (rubric) ☐ PowerPoint presentations (rubric) ☐ Performance tasks (anecdotal/scale)
Conversation ☐ Student teacher conferences (checklist) ☐ Small Group Discussions (checklist) ☐ Pair work (checklist) ☐ Debate (rubric)	**Conversation** ☐ Student teacher conferences (checklist) ☐ Small group discussions (checklist) ☐ Pair work (anecdotal) ☐ Peer-feedback (anecdotal) ☐ Peer-editing (anecdotal) ☐ Oral pre-tests (scale/rubric) ☐ Oral quizzes (scale/rubric)	**Conversation** ☐ Student teacher conferences (checklist) ☐ Question and Answer Session (checklist) ☐ Oral tests (scale/rubric)

THE FINAL GRADE

A final grade is recorded for every course, and a credit is granted for every course in which the student's final mark is 50% or higher. The final grade for this course will be determined as follows:

Percentage of Final Mark	Categories of Mark Breakdown
Term Work: 70%	Assessment of Learning conducted throughout the Term. This portion of the grade will reflect the student's most consistent level of achievement throughout the course, although special consideration will be given to more recent evidence of achievement.
Final Evaluation: 30%	• Final examination 20% • Investigation 10% This final evaluation will be based on an evaluation of achievement from all four categories for the course and of over all expectations from all units of the course.

The balance of the weighting of the categories of the achievement chart throughout the course is:

Knowledge and Understanding	25%	Application	25%
Thinking and Inquiry	25%	Communication	25%

CONSIDERATION FOR PROGRAM PLANNING

All students can succeed. Some students are able, with certain accommodations, to participate in the regular course curriculum and to demonstrate learning independently. Accommodations allow access to the course without any changes to the knowledge and skills the student is expected to demonstrate. The accommodations required to facilitate the student's learning must be identified. Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and differentiated instruction focuses on the provision of accommodations to meet the diverse needs of learners. The areas of concern to all teachers include the following:

Teaching Approaches

A much more effective way to learn is for students to be actively involved in thinking and discussing during both class and investigation activities, with the goal of having the students develop a deep understanding of scientific concepts.

In order to learn science and to apply their knowledge and skills effectively, students must develop a solid understanding of scientific concepts. Research and successful classroom practice have shown that an inquiry approach, with emphasis on learning through concrete, hands-on experiences, best enables students to develop the conceptual foundation they need. When planning science programs, teachers

will provide activities and challenges that actively engage students in inquiries that honour the ideas and skills students bring to them, while further deepening their conceptual understandings and essential skills.

Students will investigate scientific concepts using a variety of equipment, materials, and strategies. Activities are necessary for supporting the effective learning of science by all students. These active learning opportunities invite students to explore and investigate abstract scientific ideas in rich, varied, and hands-on ways. Moreover, the use of a variety of equipment and materials helps deepen and extend students' understanding of scientific concepts and further extends their development of scientific investigation skills.

Health and Safety in Science

Teachers must model safe practices at all times and communicate safety expectations to students in accordance with Ministry of Education policies and Ministry of Labour regulations. Teachers are responsible for ensuring the safety of students during classroom activities and also for encouraging and motivating students to assume responsibility for their own safety and the safety of others. Teachers must also ensure that students have the knowledge and skills needed for safe participation in science activities.
To carry out their responsibilities with regard to safety, it is important for teachers to have: concern for their own safety and that of their students; the knowledge necessary to use the materials, equipment, and procedures involved in science safely; the skills needed to perform tasks efficiently and safely. Students demonstrate that they have the knowledge, skills, and habits of mind required for safe participation in science activities.

English as A Second Language

Students whose first language is not English will be allowed to use dictionaries during assessments for and as learning. Furthermore, they will be encouraged to speak English in class through pair/group work, and small class presentations. As well, students will enhance their knowledge of science vocabulary.

Attendance (Absences)

Regular class attendance is critical for students' learning, achievement of course expectations, and successful completion of the course. Where, in the principal's judgment, a student's frequent absences from school are jeopardizing his or her successful completion of a course, school staff will meet with the student and parents to explain the potential consequences of the absences, including failure to gain credits, and to discuss steps that could be taken to improve student attendance.

Students are responsible for acquiring the work missed due to absence before the following class. Students will be accommodated with a make-up class if necessary. The teacher will use his/her professional judgment to determine alternate methods of evaluating students who are absent for a test or presentation, given the appropriate documentation.

The Role of Technology in the Curriculum

The use of technology has given students access to additional and powerful resources. Students can access internet resources and online versions of texts and simulation technology where applicable. Students will use graphing calculator/software to investigate the nature and behavior of functions in this course. Email can be a valuable communication device. Media and power point presentations will use a variety of technical applications. Word processing is expected for all written submissions.

Career Education

Ongoing scientific discoveries and innovations coupled with rapidly evolving technologies have resulted in an exciting environment in which creativity and innovation thrive, bringing about new career opportunities. Today's employers seek candidates with strong critical-thinking and problem-solving skills and the ability to work cooperatively in a team – traits that are developed through participation in the science program. The knowledge and skills that students acquire in science are useful in preparation for a variety of fields in post-secondary education. References are made throughout the course to applications in science, engineering, and computer technology related areas. Students are made aware of these options and are encouraged to investigate areas of interest to them.

GENERAL SCHOOL POLICY, AND EXPECTATIONS OF STUDENT BEHAVIOUR

Necessary Materials for Classroom

Students should come to class with the required books and equipment. This includes three ring binder, notebook, textbook, pen, pencil, graph paper, ruler and calculator. There is not point being here unless you are prepared. Items not required for class should not be in evidence. These include other books, newspapers, magazines, food, drinks, cell phones, and all other electronic devices.

Tests and Exams

Attendance for tests and exams is a **must**. If the absence is for a valid reason and can be documented (e.g. a medical certificate) a makeup test may be arranged with the teacher. A note from a parent may be accepted at the discretion of the teacher or principal.

Homework

Homework will be assigned regularly. Students are expected to complete all assigned work, on a regular basis, without exception, because it is only through consistent practice that skills and concepts are retained. Students can expect to spend approximately 2-4 hours per week on any one subject for homework or assignments. Completing homework is also a reflection of a positive attitude.

Late and Missed Assignments Policy

Students will be given ample time and opportunities to submit their work. It will be made clear to students early in the school year that they are responsible not only for their behaviour in the classroom and the school but also for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher, and in a form approved by the teacher. Students will be

understood that there will be consequences for not completing assignments for evaluation or for submitting those assignments late. Where in the teacher's professional judgement it is appropriate to do so, a number of strategies may be used to help prevent and/or address late and missed assignments as listed in the School's course calendar.

Plagiarism

Students are reminded to become familiar with the Talenta Academy's policy concerning plagiarism. Any work submitted for one course may not be submitted for another course without the permission of the teachers of both courses. The creation of original work is a celebration of your intellectual curiosity. The unacknowledged use of another person's writing or ideas is a serious academic offence that will result in a zero for the assignment. If unsure about plagiarism, then consult with the teacher.

RESOURCES:

- Physics 12, Bruni, D. Dick, G., Speijer, J., Steward, C., (2012). Toronto, Ontario: Nelson Education Ltd.
- Laboratory tools: Ramp, clock, measuring tap
- Computer Lab: Online Virtual labs, simulations, animations
- Scientific calculator
- Laptop, Projector, Television,
- Various internet websites
- Multimedia, power points