CAMOSUN COLLEGE - ELECTRONICS DEPARTMENT

ELEN 140 – TECHNICAL SCIENCE

Course Outline – Summer 2019

DESCRIPTION:

The objective of this course is to provide the Marine Electrician with a detailed introduction to the applied physical sciences through the ideas and laws that apply to many varied situations in the world around us. It is intended to provide the background knowledge essential to the understanding of many concepts taught in the other technical courses of the program.

IN-CLASS WORKLOAD:	5 hours of lecture, 1 hour of tutorial
OUT-OF-CLASS WORKLOAD:	~5 hours
LOCATION:	CBA 121
INSTRUCTOR:	Dr. Sahitya Yadav
CONTACT INFO:	TEC 264, KandurS@camosun.bc.ca
TEXT: (online resources also used)	"Physics for Technology" by Betts

1 Review of the metric and imperial systems **(Week #1)**

- 1.1 distances
- 1.2 masses
- 1.3 forces
- 1.4 metric prefixes and basic/derived units
- 1.5 unit conversions

2 Motion **(Week #2)**

- 2.1 distance and displacement
  - 2.1.1 speed and velocity
  - 2.1.2 definitions
  - 2.1.3 difference between scalar and vector
  - 2.1.4 average and instantaneous speed/velocity
  - 2.1.5 changing direction, constant speed problems
- 2.2 acceleration
- 2.3 collinear vectors
- 2.4 free-falling bodies

3 Newton's laws of motion **(Week #3 - #4)**

- 3.1 mass and weight
- 3.2 law of inertia
- 3.3 law of acceleration
  - 3.3.1 describe the relationship between force, mass and acceleration
  - 3.3.2 apply definitions of mass and weight to the second law
- 3.4 law of action and reaction
  - 3.4.1 pairs of forces
  - 3.4.2 F_{NET} = ma formula
  - 3.4.3 free-body sketches

4 Friction **(Week #5 - #6)**

- 4.1 friction equation
- 4.2 normal force
- 4.3 terminal velocity

5 Momentum **(Week #6 - #7)**

- 5.1 momentum and impulse
  - 5.1.1 definition of momentum
  - 5.1.2 compare momentum and inertia for objects at rest
  - 5.1.3 concept of impulse as change in momentum
- 5.2 conservation of momentum

6 Work, Energy and Power **(Week #7 - #8)**

- 6.1 work
- 6.2 energy
  - 6.2.1 mechanical energy
  - 6.2.2 kinetic energy
  - 6.2.3 potential energy
- 6.3 conservation of mechanical energy
- 6.4 the work-energy relationship
- 6.5 power
  - 6.5.1 definition of power
  - 6.5.2 relationship with work
  - 6.5.3 relationship between electrical and mechanical power (746 W = 1hp)

7 Rotational Motion **(Weeks #8 - #9)**

- 7.1 circular motion
  - 7.1.1 definition of circular motion
  - 7.1.2 relationship to rectilinear motion
  - 7.1.3 periodic motion, period and frequency
  - 7.1.4 centripetal force (defined using Newton's second law)
- 7.2 measurement of angles
  - 7.2.1 revolutions, degrees and radians
  - 7.2.2 conversions
- 7.3 angular motion
  - 7.3.1 angular velocity as an extension of linear velocity
  - 7.3.2 angular acceleration
  - 7.3.3 centripetal force and centripetal acceleration
- 7.4 rotational quantities
  - 7.4.1 torque and its relationship to work
  - 7.4.2 work and power

8 Simple Machines **(Week #10)**

- 8.1 six basic machines
- 8.2 examples of basic machines
- 8.3 law of simple machines
- 8.4 ideal and actual mechanical advantage and efficiency
- 8.5 first, second and third class levers
- 8.6 pulleys
  - 8.6.1 pulley
  - 8.6.2 the wheel and axle as a modified pulley
  - 8.6.3 block and tackle as a complex group of pulleys
- 8.7 gears
  - 8.7.1 gears
  - 8.7.2 relationship of belt-driven pulleys to gears
  - 8.7.3 gear trains

8.8 inclined planes
- 8.8.1 inclined plane
- 8.8.2 wedge and ideal mechanical advantage
- 8.8.3 the screw

8.9 compound machines

9 Introduction to Fluids **(Week #11)**

9.1 definition of fluid
9.2 difference between liquids and gases
9.3 Pascal's law
9.4 fluid properties
- 9.4.1 compressibility
- 9.4.2 mass;
- 9.4.3 weight
- 9.4.4 density
- 9.4.5 specific weight
- 9.4.6 specific gravity
- 9.4.7 relation between density and specific weight
- 9.4.8 fresh water properties versus salt water viscosity
- 9.4.9 viscosity and temp effects

10 Pressure Measurement **(Week #12)**

10.1 absolute and gauge pressure
10.2 gas pressure
10.3 Pascal's paradox
10.4 manometers
10.5 barometers
10.6 pressure gauges

11 Buoyancy and Stability

11.1 buoyancy and buoyant force
11.2 bodies floating on a fluid
11.3 static equilibrium
11.4 definition of stability
11.5 conditions of stability for a body to float
11.6 conditions of stability for a body to be submerged in a fluid

12 Laminar and Turbulent Flow

12.1 laminar flow
12.2 turbulent flow

13 Flow of Fluids **(Week #13)**

13.1 fluid flow rate
13.2 conservation of energy
13.3 pipe and tubing and velocity of flow
13.4 Bernoulli's equation and applications
13.5 Torricelli's theorem

14 General Energy Equation

14.1 energy losses in a fluid system
14.2 addition and removal of energy in a fluid flow system
14.3 nomenclature of energy losses and additions
14.4 general energy equation
14.5 application of general energy equation to practical problems
14.6 power required by pumps and pump efficiency
14.7 power delivered to fluid motors and fluid motor efficiency

EVALUATION:

Problem sets	(1% each x 10 Problem Sets)	10%
Quizzes	(5% each x 6 Quizzes)	30%
Midterm exam	(week #7 or #8)	30%
Final exam	(week of August)	30%

Problem sets – Solve for unknowns, review topics and apply concepts.
Quizzes – 1-2 questions to assess level of understanding of recent topics covered.
Midterm exam – Multiple types of questions to assess comprehension up to that point.
Final exam – Multiple types of questions to assess level of understanding of all topics.

Students must obtain a minimum of 60% in the course and a minimum of 50% on the final exam.

GRADING:

Letter grades will be awarded in accordance with College policy.