FU	FREDERICK UNIVERSITY	MAR512/1
	Course Outline	

Course Code:	**MAR512**
Course Title:	**Marine electrical systems and control engineering**
Level:	**Postgraduate career-based course**
Credits:	**12 ECTS**
Department:	**Maritime Transport and Commerce / Mechanical Engineering**
Pre-requisites:	**BSc or BEng Mechanical Engineering (or appropriate equivalent)**

Introduction and Rationale:

Modern merchant vessels are complex engineering structures dependent for their operation on a wide variety of mechanical, electrical and electronic systems. Good knowledge and in depth understanding of these systems therefore constitutes a major part of the marine engineering curriculum. Most of these systems are common to many types of vessels although the degree of importance and engineering complexity might vary from case to case and is subject to engineering development and progress.

Aim:

The aim of the course is to provide the fundamental engineering knowledge of common traditional marine engineering systems while introducing technology evolution as appropriate for each case, to meet the requirements of the International Maritime Organisation (IMO) Standards of Training and Certification of Watchkeepers (STCW) for Engineering Officer of the Watch (EOOW) at operational level.

Learning Outcomes:

Electricity section

On completion of this course the student will know:

- DC circuits with resistances in parallel and series.
- Power and energy in DC circuits.
- AC circuits comprising resistance capacitance and inductance, voltage and current magnification factor.
- True power, apparent power and power factor.
- Solve problems involving DC circuits with resistances in parallel and series.
- Solve problems involving power and energy in DC circuits.
- Solve problems involving AC circuit comprising resistance capacitance and inductance, voltage and current magnification factor.
- Solve problems involving true power, apparent power and power factor.
- Maintenance of and safety requirements for working on electrical equipment. Protection of generators and distribution systems.
- State the requirements for safe working on electrical equipment, stating the procedure for treatment of electric shock. State the procedure for working near live equipment.
- Describe the maintenance required for electrical motors and electrical systems. Explain the cause, detection and prevention of earth faults. Differentiate between earthed and insulated neutral systems.
- State the requirements and procedure for paralleling of generators. Explain the consequences of incorrect paralleling and the protection devices fitted.

- Describe the switchboard protection devices for protection of generators and distribution system, explaining the need for discrimination.
- Describe the operation, testing and maintenance of the emergency alternator, together with the emergency battery supply.
- Operation and maintenance of storage batteries. Differentiate between different types of storage batteries, stating their uses. Describe the maintenance required and the precautions to be taken.
- Conventions and interpretation of electrical circuit diagrams. Identify items within a circuit diagram and explain possible effects of faults.

Learning Outcomes:

Control section

On completion of this course the student will know:

- Instruments.
- Operation and application of a range of transducers suitable for measuring the following variables: temperature, flow, displacement, viscosity, pressure, strain, position and level.
- Explain the following properties of a transducer: range, accuracy, repeatability, sensitivity, resolution, linearity and hysteresis.
- Identification of suitable transducers for various control systems.
- Regulators
- Control of level, temperature, pressure. Describe the control of systems using two step control, proportional control describing the operation of the transducer.
- Describe the operation of pneumatic and electrical actuators. Explain the use and operation of positioners.
- Fail safe and fail set. Explain failure modes, giving examples for different systems.
- Identification of suitable actuators for given control systems.
- Control Systems
- Describe the behaviour of an on-off type of control system and give an example of an application.
- Draw a block diagram of a specified closed loop control system consisting of a controller, external input (set point), error detector, error signal, actuator, regulator, manipulated variable, process, controlled variable, feedback loop, transducer and any appropriate signal conditioning devices.
- Continuous control systems.
- Draw an output/time graph showing the transient and steady state response of a closed loop system in response to a unit step input. The graph should be labelled with steady state error, time to peak, time to settle, overshoot and final value.
- Draw labelled graphs showing over damped, under damped, and critically damped behaviour in a closed loop system.
- Explain Gain/Proportional band, integral action time, and derivative action time. Choose the appropriate action and/or actions for given systems.
- Draw graphs to show the effects of change of P, I and D variables on system response referencing; set point/load changes, offset/steady state errors, overshoot, initial rate of change and settling time.
- System Diagrams
- Conventions and interpretation of systems drawn to BS1553 and BS1646. Identify and explain the purpose of symbols highlighted on a typical Pipe and Instrument Diagram.

Main Learning and Teaching Activities:

Lectures will provide a conceptual framework of all key areas. Students will work individually and/or in groups for their assignments. Computer based learning packages, simulation, Universities resources and industrial visits will support familiarisation with the various types of marine equipment where applicable. Guest lecturers from industry will supplement practical input and experience whenever possible.		
Assessment Details:		
Method of assessment	**Weighting %**	**Outline detail**
Coursework	40%	2 individual assignments: 1 assignment on Marine Electrical Systems 1 assignment on Marine Control Systems
Examination	60%	Closed book 3 hour combined written exam: Part A 1.5 hours – Marine Electrical Systems Part B 1.5 hours – Marine Control Systems