

PAST PAPERS

<i>Faculty</i>	<i>Department / Section/Division</i>
<i>Not Applicable</i>	<i>Learning Resource Centre</i>

Past Papers

Faculty of Maritime Science
Department of Marine Electrical

**Marine Electro Technical Officer
(COC)
(Academic Past Papers)**

2022

<i>Document Control & Approving Authority</i>	<i>Senior Director - Quality Management & Administration</i>
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MINISTRY OF PORTS AND SHIPPING
MERCHANT SHIPPING SECRETARIAT - SRI LANKA

CERTIFICATE OF COMPETENCY
Electro-Technical Officer (STCW III/6)



EXAMINATION QUESTION PAPER
MARINE ELECTRICAL PRACTICE - HIGH VOLTAGE

- This question paper consist of 06 questions.
- Answer any 05 questions.

Pass mark 50%

Date: 2022.08.04
Time allocated: 03Hrs

01. With reference to Protection relays in High Voltage Panel
 - a. List features of Digital protection relay used in High Voltage Panels (05 Marks)
 - b. What are the advantages of Digital protection relays (05 Marks)
 - c. List of minimum protections provided by Digital protection relays (05 Marks)
 - d. List of External devices connected to Digital protection relays of a Generator Panel (05 Marks)
02. With reference to Instrument transformers
 - a. What is the purpose of Potential Transformer & Current transformer in HV Panel (05 Marks)
 - b. Which compartment of the HV Generator panel is most suitable for Installing PT & CT (05 Marks)
 - c. What is the most important Protection required for the Potential Transformer (05 Marks)
 - d. What are the important Technical Specification to be checked before replacement of device used for short circuit Protection of the PT (05 Marks)
03. With reference to Advantages and Disadvantages of High Voltage systems on board ships
 - a. Write down Advantages of high voltage systems onboard ships (06 Marks)
 - b. Write down disadvantages of high voltage systems onboard (06 Marks)
 - c. Why modern ships are designed with HV systems (04 Marks)
 - d. List and explain four types of earthing used in HV systems (04 Marks)
04. With reference to High Voltage Risk Assessment
 - a. What is the purpose of RISK assessment on HV systems (06 Marks)
 - b. What are the documents, information can be useful for successful risk assessment (10 Marks)
 - c. Where updated High Voltage safety practices are available for reference (04 Marks)
05. With reference to High Voltage - Personal protective equipment
 - a. List ten Personal Protective Equipment required to Work safely on HV system onboard (10 Marks)
 - b. What are the Technical specifications of the PPE suitable for HV work (05 Marks)
 - c. How to check an Electrically Insulated gloves suitable for HV Maintenance (05 Marks)
06. With reference to High voltage Panels Electrical & Physical Structure
 - a. What are the or structural construction differences between LV panel and HV Panel (06 Marks)
 - b. List additional Electrical features available in the HV panels compared to LV panels (04 Marks)

- c. List additional safety features available in the HV panels compared to LV panels
d. List two Interlocks used to block access of compartments in HV Panel

(06 Marks)
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(04 Marks)



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EXAMINATION QUESTION PAPER
AUTOMATION, INSTRUMENTATION & ELECTRONICS.

- This question paper consists of 3 sections, 08 questions.
- Answer 2 Questions from Section A, 2 questions from section B and all questions from section C

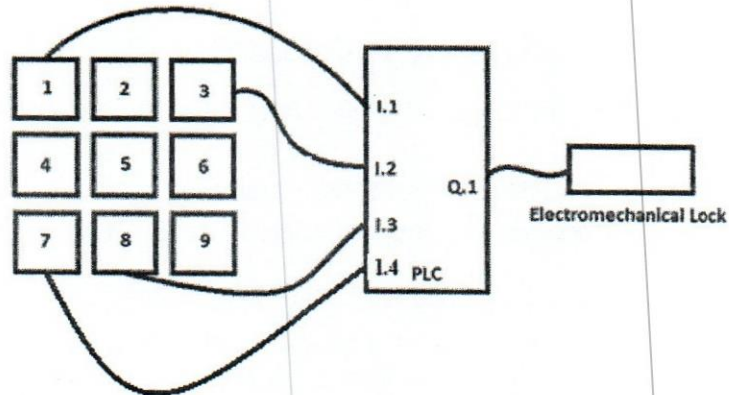
Date: 2022.08.05

Pass mark 50%

Time allocated: 03Hr

Section A - Control Systems

1. With regards to the marine process control,
 - a. Defines and explain the differences of digital and analog control circuits. (04 Marks)
 - b. Describe data processing in process control as
 - i. Analog data processing (06 Marks)
 - ii. Digital data processing (06 Marks)
2. With regards to the controlled functions in process control, describe shortly
 - a. Single controlled objects, (05 Marks)
 - b. Groups of objects (05 Marks)
 - c. Hierarchical structure. (06 Marks)
3. With regards to Programmable logic controllers,
 - a. Defines and characterizes about Programmable Logic Controllers and Programmable Automatic Controllers. (04 Marks)
 - b. Compare the differences between modular and compact PLC devices. (04 Marks)
 - c. A 4-digit code lock has to be designed by using a PLC. Once the code is correctly entered, the lock should be opened only for 10 seconds of time period. After the expiration of that time, the door should be relocked automatically and the code has to be entered to unlock the door again. The input output arrangement is as follows.
(consider the electromechanical lock is releasing when its input is high)
The sequence of numbers are 1,3,8,7
Draw a ladder diagram for above system. (08 Marks)



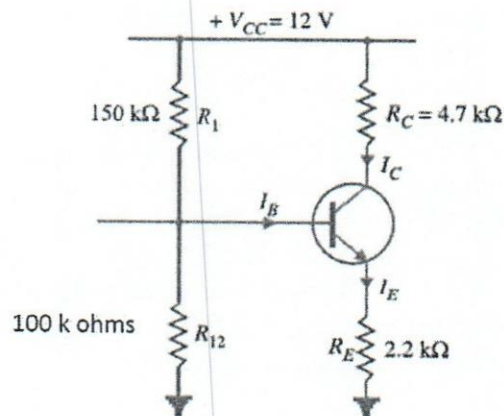
Section B - Electronics and power electronics

4. With regards to Thyristors

- Draw the circuit diagram of single-phase ac voltage controller, with back to back SCR arrangements and sketch output voltage and current waveforms for the firing angle of α .
(06 Marks)
- Draw the circuit diagram of 3-phase ac voltage controller with back to back SCR arrangements.
(04 Marks)
- Explain the operation of a single phase Cycloconverter with the aid of sketches. Also mention about the voltage controlling and frequency controlling concepts.
(06 Marks)

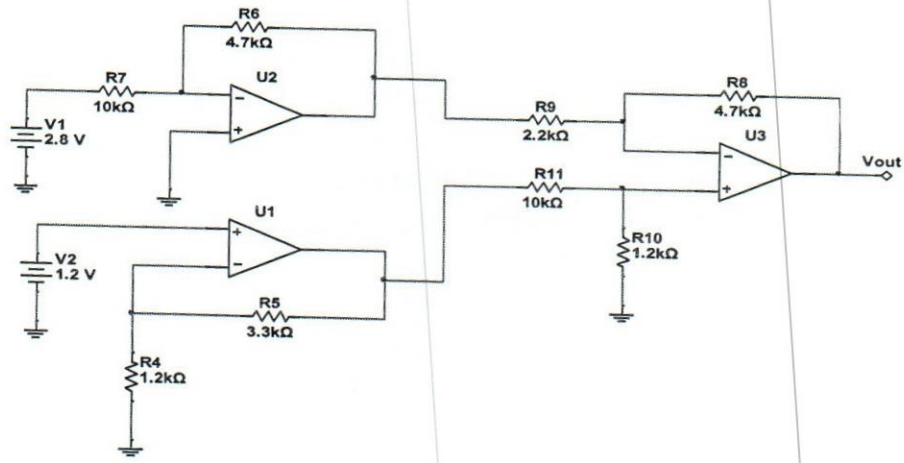
5. With regards to the bipolar junction transistors, given that $\beta = 50$ and $V_{BE} = 0.7V$, for the circuit shown in following figure,

- Find the operating point (Q point).
(10 Marks)
- Draw the load-line for the transistor.
(06 Marks)



6. With regards to the operational amplifiers,

- Describe the difference between Ideal and Practical Operational Amplifier.
(06 Marks)
- In following Op-Amp circuit, find the value of the output voltage (V_{out})
(10 Marks)



Section 3 - Measurements and instrumentation

7. With regards to the measurement and instrumentation,
- What is a Protocol? Describe the communication with SMART transducers using HART protocol. (08 Marks)
 - Describe how the temperature is measured by a 3-wire Pt-100 sensor, with a typical long distance analog measuring line. (08 Marks)
8. With regards to the measurement devices in the marine industry, describe the structure of followings,
- Temperature (04 Marks)
 - Proximity (04 Marks)
 - Level (04 Marks)
 - Oil in water (04 Marks)

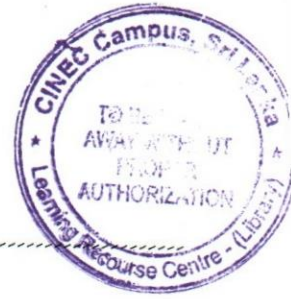
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EXAMINATION QUESTION PAPER
SHIP BOARD HYDRAULIC & PNEUMATIC & ELECTRICAL PRACTICE

- This question paper consists of 07 questions.
- Answer any six questions.

Date: 2022.08.03

Pass mark 50%

Time allocated: 03Hrs

- 01). a. Draw a hydraulic power pack and List out all the attached components with ISO symbols. (08 Marks)
- b. What are the daily routine checks and periodical preventive maintenance work of a power pack? (04 Marks)
- c. What is the function of a pressure limiting valve of a power pack? (04 Marks)
- 02). a. Draw the following pneumatic components ISO symbols. (06 Marks)
- i. One way flow control valve, adjustable
 - ii. Directional control valve 4/3-way valve, closed neutral position.
 - iii. Single pilot operates spring neutral normally open 3 ports, 2 position directional control valve.
- (b) Draw a diagram and explain the function of a Valve positioner used in a pneumatic control system (10 Marks)
- 03). (a) Draw a diagram and explain the operation of Remote Ballast valve control system used in ship board operation (10 Marks)
- (b) State THREE faults encounter in this system how they can be rectified (6 Marks)
04. (a) Explain the following control systems with suitable diagrams if required
- i. Two step ON / OFF control. (4 Marks)
 - II. Proportional control using flapper & nozzle. (6 Marks)
- (b) Explain what problems are encountered pneumatic flapper & nozzle control systems how they can be minimized. (6 Marks)

05. (a) With a suitable diagram explain the operation of a Four ram steering gear. (10 Marks)
- (b). Explain the procedure how emergency local steering control can be carried out. Explain under what conditions this procedure need to be carried out. (6 Marks)
- 06). a. With appropriate diagrams explain how speed control and reversing of the Controllable Pitch Propeller is carried out. (10 Marks)
- b. Explain what safety features are incorporated with the above system. (06 Marks).
07. (a) With regards to hydraulically operated Deck Cranes used in ship board practices with suitable diagrams explain how the following functions are carried out.
- (i) Hoisting and Lowering of Cargo hook. (6 marks)
 - (ii) Luffing of the jib. (5 marks)
 - (iii) Slewing of the system. (5 Marks)



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CERTIFICATE OF COMPETENCY
Electro-Technical Officer (STCW III/6)

MARINE ELECTRO TECHNOLOGY & POWER TECHNOLOGY

- This question paper consists of 07 questions.
- Answer any 06 questions.

Date: 2022.08.01

Pass mark 50%

Time allocated: 03Hrs

01. With reference to network theorems

- With aid of suitable sketches, explain the Kirchhoff's laws. (04 Marks)
- Determine the current passing through 10Ω resistor shown in figure 01. (Using Kirchhoff's laws) (12 Marks)

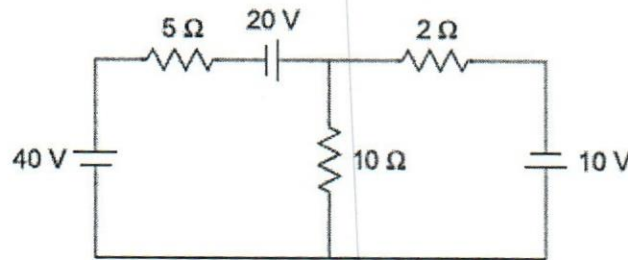


figure 01

02. With reference to AC circuit theory

- Write down equations for currents with respect to the voltage for the waveform diagrams shown in figure 02 below. (04 Marks)

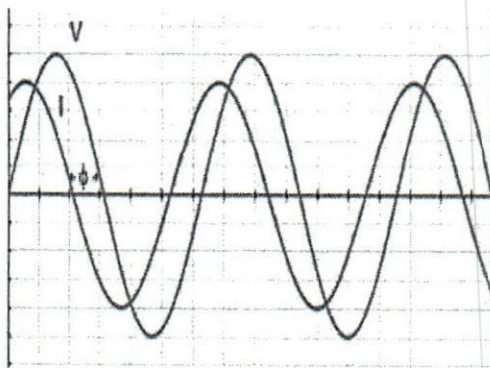


Figure 2a

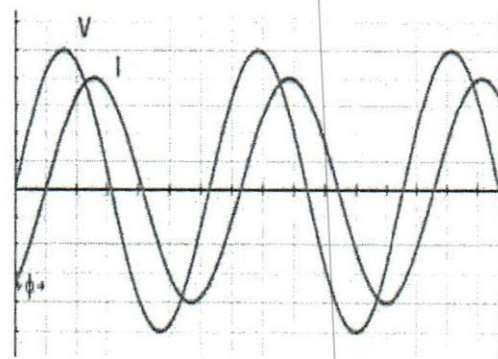


Figure 2b

- Draw the phasor diagrams for voltage and current for the above part I (04 Marks)

- b. Find the expression for the resultant instantaneous current in the form $I = I_m \sin(\omega t \pm \phi)$, when following currents are added together.

$$I_1 = 40 \sin \omega t$$

$$I_2 = 30 \sin(\omega t + \pi/3)$$

$$I_3 = 50 \sin(\omega t + \pi/4)$$

$$I_4 = 20 \sin(\omega t - \pi/2)$$

(08 Marks)

03. With reference to RLC circuits

- a. i. Draw the phasor diagram for Voltage V , V_R , V_C and I shown in figure 3. (04 Marks)
 ii. Draw the waveform diagrams for the above quantities given in part i. (03 Marks)
 iii. Write down the equation for the impedance of the circuit. (02 Marks)

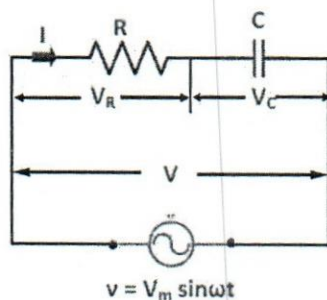


Figure 3

- b. A 10Ω resistor and $400 \mu\text{f}$ capacitor are connected in series to a 60V sinusoidal supply. The circuit current 5A . Calculate
- the supply frequency (03 Marks)
 - phase angle between the current & voltage. (02 Marks)
 - Power consumed by the circuit (02 Marks)

04. With reference to generators

- a. Describe with a aid of a block diagram, how automatic starting, load sharing and stopping of generators in response to load changing is effected. (08 Marks)
 b. Sketch a load/ frequency diagram showing two generators with similar speed droops sharing the electrical load. (08 Marks)

05. With reference to AC switchboards.

- a. State with reasons what protection devices are fitted (10 Marks)
 b. Explain the term "Preferential Tripping" describing how it is achieved (06 Marks)

06. With reference to Induction motors.
- a. Sketch the torque / slip curve explaining its salient points. (06 Marks)
 - b. Describe how starting torque of an induction motor can be improved by using each of the following
 - i. Wound Rotor. (05 Marks)
 - ii. Double cage (05 Marks)
07. With reference to Automatic voltage regulators fitted to electric Generators:
- a. State the purpose of AVR and explain its operation with a block diagram (08 Marks)
 - b. State an acceptable recovery time from initiation of a voltage change (02 Marks)
 - c. In control system, explain those elements that provide
 - i. Stability. (02 Marks)
 - ii. Load Change. (02 Marks)
 - iii. Fast Response. (02 Marks)