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Faculty of Marine Engineering
Department of Marine Electrical Engineering
ELECTRO TECHNICAL OFFICER CADETS TRAINING COURSE-P3
COURSE CODE: EED -2475P3/ B005

EXAMINATION QUESTION PAPER
MARINE ELECTRICAL ENGINEERING PRACTICE & BRIDGE AND NAVIGATION.

- *This question paper consists 08 questions.*
- *Answer any 06 (Six) Questions.*

Date: 2023.08.24 *Pass marks 50%* *Time allocated: 03Hrs*

01. a. State principle components of a traction elevator & explain their functions. (08 Marks)

b. Explain in detail what maintenance are required to make sure above mentioned components are operational. (08 Marks)

02. a. Explain the following components stating what maintenance are required to keep them in service condition.
   i. Lead-Acid Battery. (03 Marks)
   ii. Alkaline Battery (03 Marks)
   iii. Battery charging system in shipboard practice. (03 Marks)

b. Explain what safety precaution are required in ship's battery rooms and how do you achieve them. (07 Marks)

03. With reference to the voltage variation contour due to load variations of AC generators during starting of heavy consumers such as bow thrusters,

a. Sketch voltage dip, mentioning the acceptable recovery time (02 Marks)
b. Describe the function of AVR with the aid of a block diagram (06 Marks)
c. State 3 starting methods to reduce the voltage dip while starting of comparatively large sized 3 phase induction motors and explain one with aid of a circuit diagram (08 Marks)

04. With regard to coupling ,Load sharing and changing over generators and power management system functions,

a. Explain the following methods of synchronization of generators to the bus bar and its differences. (09 Marks)
   i. Automatic Synchronization
   ii. Check synchronization.
   iii. Manual synchronization
b. Discuss 3 step load disconnection system from generator and its importance aid of a block diagram showing timings. (04 Marks)
c. Describe the conditions for automatic starting of emergency generator and starting methods (03 Marks)

05. a. Describe the clock synchronization process performed by GPS receivers (08 Marks)

b. What is Clock Bias (08 Marks)

06. a. Describe areas covered in the AIS annual survey (08 Marks)

b. Describe the operation of satellite based AIS system. (08 Marks)

07. a. With aid of a sketch, describe the main component parts of a Marine Radar Transceiver. (08 Marks)

b. Explain the use of "Power Monitor" and "Performance Monitor" in identifying Radar faults. (08 Marks)

08. Explain the principle of multiplexors (MUX) and De-multiplexer (DEMUX) and their applications in telephone systems (16 Marks)

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Faculty of Marine Engineering
Department of Marine Electrical Engineering
ELECTRO TECHNICAL OFFICER CADETS TRAINING COURSE P3
COURSE CODE: EED -2475P3/ B005

EXAMINATION QUESTION PAPER
ELECTRONICS & ELECTRO TECHNOLOGY

- *This question paper consists 08 questions.*
- *Answer any 06 (Six) Questions.*

Date: 2023.02.23 *Pass marks 50%* *Time allocated: 03Hrs*

01. With regards to the basic control theory,
    a. Explain the mathematical representation of following control concepts.
        i. Proportional (P) control (03 Marks)
        ii. Integral (I) control (03 Marks)
        iii. Derivative (d) control (03 Marks)
        iv. PID control (03 Marks)

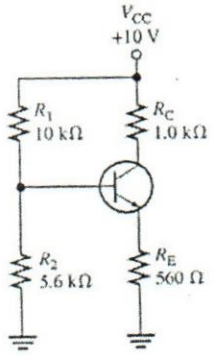
    b. Explain the impact on Raise time (Tr), Overshoot (Mp), and Steady state error (Ess) with the increase of P, I and D parameters respectively. (04 Marks)

02. With regards to the actuators used in process control, briefly describe on
    a. Hydraulic motors (04 Marks)
    b. 4-20mA Control valves (04 Marks)
    c. Induction motors (04 Marks)
    d. Electro pneumatic Valves (04 Marks)

03. With regards to the transistors
    a. Draw the out put characteristic curve of a npn trasistor in common emitter configuration (05 Marks)

    b. State one application for each of the following (03 Marks)
        a. MOSFET
        b. JFET
        c. IGBT

    c. Determine VCE and IC in the voltage divider biased transistor circuit.Assume VBE = 0.6 V , β = 120 and IE = IC (08 Marks)



04. Describe the principle of operation, parameters and applications of following semiconductor elements

a. Gate turn off (GTO) (04 Marks)
b. The integrated gate-commutated thyristor (IGCT) (04 Marks)
c. Insulated-gate bipolar transistor (IGBT) (04 Marks)
d. Silicon controlled rectifier (SCR) (04 Marks)

05. The primary and secondary of a transformer has a resistance of 0.39 Ohm and 0.002 respectively. The rating is 500kVA, 6600/440 V. The iron loss of the transformer is 3.0kW.If the load power factor is 0.8 find,

a. Efficiency at full load (08 Marks)
b. Efficiency at haif load (08 Marks)

06. a. Find the resultant equation of following voltages when they are added together.

$V1=25 \sin \omega t$
$V2=30 \sin (\omega t+\pi/6)$
$V3=30 \cos \omega t$
$V4=20 \sin (\omega t-\pi/4)$ (06 Marks)

b. What is the value of time elapsed, from the instant V1 is zero and V1 becoming 15Volt for the first time? (04 Marks)

c. What is the value of time elapsed, after one full cycle, from the instant mentioned in above part (04 Marks)

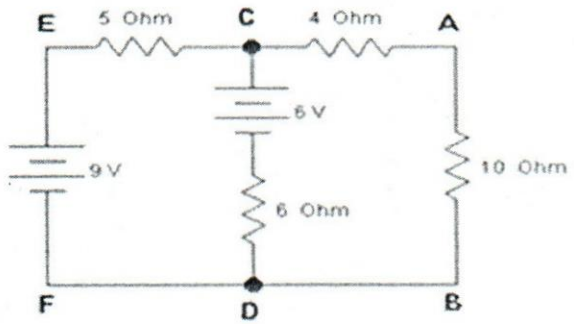
d. Find the RMS values of V1 and V2 (02 Marks)

07. The secondary of a 3-phase star connected transformer which has a phase voltage of 3811 V, feeds a star connected load each phase of which has a resistance of 1500 Ohm and an inductive reactance of 1000 Ohm. Calculate the

a. Line Voltage (03 Marks)
b. Current in each phase of the load (03 Marks)
c. Current in the transformer secondary windings (04 Marks)
d. Total power taken from the supply (03 Marks)
e. Load power factor (03 Marks)

08. a. State Kirchhoff's Laws using suitable sketches. (04 Marks)

b. Using the Kirchhoff's Laws find the current through 10 Ohm resistor and potential difference across 6 Ohm resistor. What is the state of batteries (Charging/Discharging). (12 Marks)



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MINISTRY OF PORTS AND SHIPPING
MERCHANT SHIPPING SECRETARIAT - SRI LANKA

ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE

EXAMINATION QUESTION PAPER

SHIP BOARD HYDRAULIC & PNEUMATIC & ELECTRICAL PRACTICE

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

Date: Pass mark 50% Time allocated: 03Hrs

01). a. What is the difference between Directional control servo valve and Directional Control Proportional valve? Briefly explain with ISO symbols. (06 Marks)

b. Name the 03 methods of hydraulic pipe fittings on board. (03 Marks)

c. What is the backup ring of a hydraulic actuator? (02 Marks)

d. Write the causes for any 5 of the following contaminant types. (05 Marks)

i Abrasion.
ii Erosion.
iii Adhesion.
iv Fatigue.
v Cavitation.
vi Corrosion.
vii Aeration.

02). a. Briefly explain the pressure compensated adjustable flow rate control valve with a sketch. (06 Marks)

b. Briefly explain Axial piston pump and Radial piston pump. What are the advantages of those pumps against gear pump. (10 Marks)

03). a. Draw two logic valves of signal processing element and explain their operation for equal pressures and differential pressures. (04 Marks)

b. In a pneumatic circuit diagram if an airline were drawn to the left square of normally closed 3 by 2-way roller lever limit valve what can you understand? What are other methods to indicate above situation? (04 Marks)

c. What is the meaning of meter in & meter out control of a double acting actuator? Draw sketch for above 2 situations. (08 Marks)

04). For the following components draw ISO slandered pneumatic diagrams.

a. Off delay timer valve. (04 Marks)

b. Adjustable pressure sequence valve. (04 Marks)

c. Internal pilot normally close spring return 3 ports by 2-way roller lever limit valve. (04 Marks)

d. Quick exhaust valve. (02 Marks)

e. Adjustable pressure regulating valve with overloads venting facility. (02 Marks)

05). a. Explain the with reasons why the following faults occur and how to rectify them

i. Compressor short cycling. (03 Marks)

ii. Unable to maintain set temperatures. (03 Marks)

iii. Compressor icing up. (03 Marks)

iv. Low discharge Pressure. (03 Marks)

b. Explain the following with reference to Air Conditioning

i. Relative Humidity. (02 Marks)

ii. Dew Point. (02 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). With regards to Elevators used in shipboard practice

a. List the main components of an Elevator. (04 Marks)

b. Describe the maintenance procedure for above listed parts (08 Marks)

c. Explain the functional testing procedure of the safety devices (04 Marks)

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ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE.

EXAMINATION QUESTION PAPER
AUTOMATION , INSTRUMENTATION & ELECTRONICS.

- This question paper consists of 3 sections , 08 questions.
- Answer 2 Questions from Section 1, 2 questions from section 2 and 1 question from section 3

Date: Pass mark 50% Time allocated: 03Hrs

Section 1 - Electronics and power electronics

01. a. Describe the pn junction. (02 Marks)

b. Briefly explain what is meant by depletion region. (02 Marks)

c. Draw symbol of a diode and identify terminals. (02 Marks)

d. Why current is flowing in one direction of a diode and not on the other direction? (02 Marks)

e. Name advantages of using IC regulator 78XX series and draw the circuit with input and output connection to the regulator. (02 Marks)

f. Indicate all important specifications you consider when ordering a replacement diode for a generator rotating diode set. (Hint: Consider a stud type diode.) (04 Marks)

g. Draw the block diagram of a regulated D.C. power supply and explain the function of each block in it with relevant waveforms. (06 Marks)

02. a. Briefly describe what is meant by intrinsic semiconductor and extrinsic semiconductor. (02 Marks)

b. Write notes on reverse bias and forward bias. (02 Marks)

c. Draw symbol of a Zener diode and identify terminals. (02 Marks)

d. Draw the V-I characteristic curve of a Zener diode and mark all important points and areas on the curve. (02 Marks)

e. Write a short note about Avalanche breakdown. (02 Marks)

f. JFET is a voltage control device. Explain this. Also mention what is meant by pinch off voltage. (Hint: Use diagrams, curves where necessary.) (04 Marks)

g. Explain PWM technique in detail with necessary sketch and waveform. (Hint: Use op amp comparator as the building block.) (06 Marks

03. a. What is meant by doping a semiconductor? (02 Marks)

b. Briefly describe what is meant by n-type semiconductor and p-type semiconductor. (02 Marks)

c. What is PIV rating of a diode? (02 Marks)

d. Why PIV rating is important in designing a rectifier circuit? (02 Marks)

e. Write a short note about Zener breakdown. (02 Marks)

f. Zener diode is a voltage regulator element. Briefly explain this with V-I characteristic curve and mark all important points and regions on it. (02 Marks)

g. Identify diode D1 with its proper technical name. (02 Marks)

h. An opamp circuit is used to drive a relay coil as shown in below circuit. Describe the purpose of having D1 and D2 in the circuit. (Fig 3.h) (06 Marks)

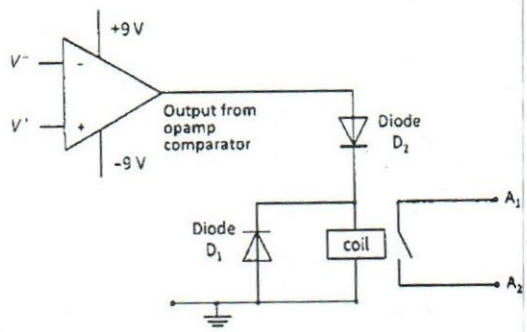


Figure 3.h

Section 2 - Control Systems

04. With regards to the control systems.

a. Explains methods of control systems as per following descriptions. (06 Marks)
   i. Static control methods
   ii. Dynamic control methods

b. Describe the properties of digital and Analog controllers. (06 Marks)

c. Explain the steps of the maintenance of PC and PLC on board. (08 Marks)

05. With regards to the control systems.

a. What is a computer control system and comment about the reliability of the same. (06 Marks)

b. Draw the typical control curve and name its important parameters. (06 Marks)

c. Describe the procedure of the manual tuning of a PID controller. (08 Marks)

06. With regards to the programmable logic controllers (PLC).

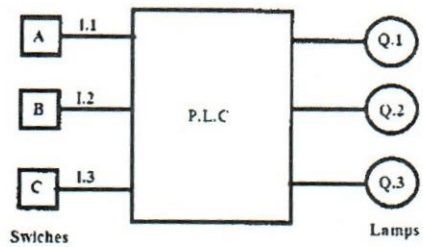
a. Defines and characterizes about Programmable Logic Controllers and Programmable Automatic Controllers. (06 Marks)

b. With regard to the following PLC function as per the given conditions in the table,

i. Obtain Boolean expressions for each output (Q.1, Q.2 and Q.3) in terms of inputs (A, B and C).

(04 Marks)

ii. Draw a ladder diagram for the above system. (10 Marks)



SWITCHING CONDITIONS	SWITCHES			LAMPS		
	A	B	C	Q.1	Q.2	Q.3
1	OFF	OFF	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	ON	OFF	OFF
3	OFF	ON	OFF	OFF	ON	OFF
4	OFF	OFF	ON	OFF	OFF	ON
5	ON	ON	OFF	OFF	ON	ON
6	OFF	ON	ON	ON	ON	OFF
7	ON	OFF	ON	ON	OFF	ON
8	ON	ON	ON	OFF	OFF	OFF

Section 3 - Measurements and instrumentation

07. With regards to the sensors, explain the method of typical long distance analog measuring systems for:

a. Temperature with: (12 Marks)
   i. Pt-100 sensor (two and three wire connections)
   ii. thermocouple (extension wires)

b. Pressure (08 Marks)

08. With regards to the sensors, explain long distance digital (on-off) measuring lines for

a. Classical on-off contact only. (04 Marks)

b. With supervision of the wires (brake or/and short circuit wires, respectively with one resistor or two resistors) (08 Marks)

c. Two wires NAMUR for hazardous areas. (08 Marks)

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MINISTRY OF PORTS AND SHIPPING
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ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE

EXAMINATION QUESTION PAPER
MARINE LEGISLATION & NAVIGATIONAL EQUIPMENT

- This question paper consist 07 questions.
- Answer any 06 questions only.

Date: Pass mark 50% Time allocated: 03Hrs

01. With reference to Shipboard Incinerators

a. Describe it's operation on Marpol Annex VI. (04 Marks)

b. Explain what common faults can be observed in operation of Incinerators which may effect Marpol Annex VI regulations. (06 Marks)

c. State what alarms are incorporated in Incinerators and how do you test them (06 Marks)

02. a. Explain in detail why Ballast Water Convention had to be implemented. (04 Marks)

b. State under what conditions Ballast Water exchange can be carried out. (04 Marks)

c. What entries should be made in the Ballast Water Record Book. (04 Marks)

d. Explain briefly what is the Ballast water treatment system. (04 Marks)

03. With reference to Oily Water separators (OWS).

a. Describe the purpose of Annex I of MARPOL Convention (04 Marks)

b. Describe with a Aid of a sketch, the circuit for interface detection. (04 Marks)

c. Explain the consequences if the interface position is incorrect. (04 Marks)

d. What is meant by special areas for the purpose of Annex I (04 Marks)

04. Describe the Structure Range and Maintenance of Iridium satellite system (16 Marks)

05. a. Write brief notes of main components and their functions of an Echo sounder system you are familiar with, explaining maintenance they require. (08 Marks)

b. Explain the main components, operation of the following.

i. Voyage Data Recorder. (04 Marks)

ii. Navigation Light controls and Alarm system (04 Marks)

06. With aid of a sketch, describe the main components and their functions of a Marine Radar transceiver

(16 Marks)

07. With aid of a diagram clearly show the connection of GPS to Navigational and GMDSS Radio equipment

(16 Marks)

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ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE

EXAMINATION QUESTION PAPER
MARINE ELECTRO TECHNOLOGY & POWER TECHNOLOGY

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

Date: Pass mark 50% Time allocated: 03 Hrs

01. a. With aid of suitable diagram, explain the Kirchhoff's laws. (04 Marks)

b. Determine the current passing through R_3, 100Ω resistor shown in figure 01. (12 Marks)

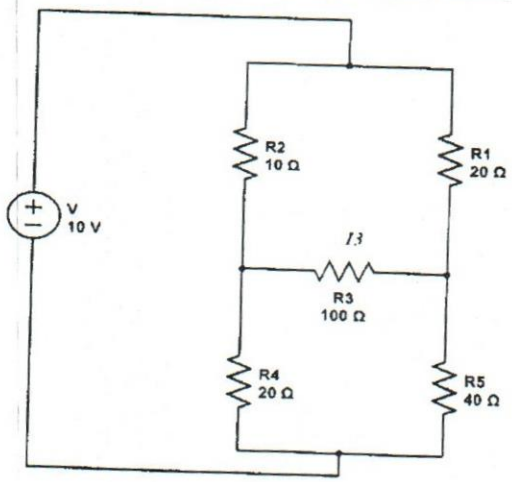
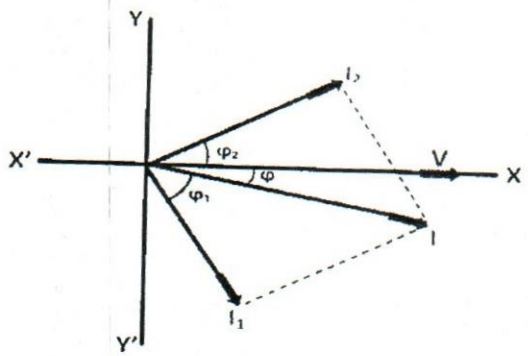


figure 01

02. a. i. Draw the wave form diagrams to show the leading and lagging wave forms with respect to a reference wave. (02 Marks)

ii. Write down the instantaneous voltage equations for leading and lagging waves with respect to the reference wave. (02 Marks)



iii. Write down the equations for I, I_1, I_2 with respect to the voltage V for the above phasor diagram. (06 Marks)

b. A circuit consist of four loads in series. The voltage across each load in given by the following relation measurement in volts.

$V_1 = 30 \sin \omega t$

$V_2 = 20 \sin (\omega t + 60^0)$

$V_3 = 40 \sin (\omega t + \pi/2)$

$V_4 = 24 \sqrt{2} \sin (\omega t - \pi/4)$

Calculate the supply voltage given the relation in sinusoidal form (06 Marks)

03. 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)

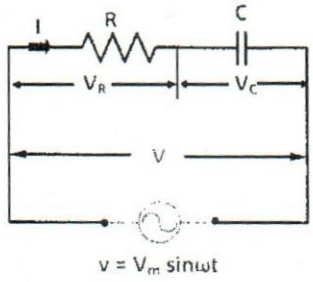


Figure 3

b. A 10 Ω resistor and 400μf capacitor are connected in series to a 60V sinusoidal supply. The circuit current 5A. Calculate

i. the supply frequency (03 Marks)

ii. phase angle between the current & voltage. (02 Marks)

iii. Power consumed of the circuit (02 Marks)

04 a. Describe with the aid of a diagram, the operation of a load sensing electronic governor controller for an AC generator. (10 Marks)

b. State what is meant by Governor speed droop, why it is necessary in generator load sharing. (06 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 the protection of electric motors, explain each of the following

a. Fuse back up protection. (04 Marks)

b. Why fuses are not suitable for over current protection. (04 Marks)

c. How motor fitted with a fuse back up protection may exceed its rated temperature without being tripped by its primary protection. (04 Marks)

d. Means of protection for a motor to safeguard the rated temperature being exceeded. (04 Marks)