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## I. INTRODUCTION

The Republic of Liberia examination system reflects the provisions of the International Convention on Standards of Training, Certification, and Watchkeeping (1978), as amended in 1995. Under this system, the examinations consist of multiple-choice questions randomly compiled by computer from a database of some 10,000 questions each appropriate for the competency being tested. The answers are again graded by computer.

Certain training pre-requisites for certification apply. It is recommended that the publication RLM-118, "Requirements for Merchant Marine Personnel Certification," be consulted to determine which other examinations, certified training or sea service may be required by the Administration before an examination may be taken.

The following test centers have been designated for the administration of all officer certificates and/or special qualifications examinations:

The International Trust Company of Liberia, Monrovia, Liberia  
Office of Deputy Commissioner, c/o LISCR, New York, NY, USA  
LISCR, Vienna, VA, USA  
LISCR (Greece), Piraeus, Greece  
LISCR, London, UK  
LISCR (Far East), Hong Kong  
Mearns Marine Agency, Aberdeen Scotland (MODU only)  
Houston Marine Consultants, New Orleans, LA, USA  
American Bureau of Shipping, Taipei, Taiwan, ROC

This booklet has been assembled to familiarize candidates for engineer officers' examinations with the examination syllabus and format. It contains information on:

- a. the examination syllabus;
- b. examination procedures and passmark requirements;
- c. examination answer sheet instructions; general advice on taking multiple-choice examinations;
- d. specimen examination questions, with an answer key;
- e. a study bibliography and sources where the recommended books may be ordered;
- f. a table of SI and Imperial units and conversion factors; and
- g. English Language Proficiency Exam.

## II. SYLLABUS

Following is a list of the main sections and the subsections of the examination syllabus. Each of the five sections of the syllabus corresponds to an examination paper (e.g., 1.0 is Diesel Propulsion Plant). Candidates' knowledge of each subsection will be tested.

All questions concern knowledge that is considered indicative of basic competence in performance of shipboard duties of marine engineers.

Motor candidates will be examined in Parts 1, 3, 4 and 5 only. Steam candidates will be examined in Parts 2, 3, 4 and 5 only. Combined candidates will be examined in Parts 1, 2, 3, 4 and 5.

## **CHIEF ENGINEER AND FIRST ASSISTANT ENGINEER**

### **1. 0 DIESEL PROPULSION PLANT**

1. 1 Applied Heat (Thermodynamics & Heat Transmission); Applied Mechanics and Hydromechanics
1. 2 2 and 4 Stroke Cycles
1. 3 Scavenging and Supercharging
1. 4 Fuel System; Fuel Combustion Process
1. 5 Cylinder and Piston Construction; Bearings
1. 6 Lubrication Systems and Lubricating Oil Treatment
1. 7 Cooling Systems; Shutting Down Engine in Port
1. 8 Preparation for Starting; Starting Air and Reversing Systems
1. 9 Speed Control and Maneuvering
- 1.10 Emergency Running
- 1.11 Camshafts and Valve Timing; Clutches, Gearing and Chain Drives
- 1.12 Crankshaft Construction and Crankshaft Deflections
- 1.13 Crankcase Mist Detection; Scavenge Fires and Crankcase Explosions
- 1.14 Main Engine Condition Monitoring
- 1.15 Exhaust Gas Boilers
- 1.16 Cylinder Diagrams
- 1.17 Sea Water Systems and Treatment
- 1.18 Bedplate and Main Frame Construction
- 1.19 Exhaust and Inlet Valves
- 1.20 Engineering Administration and Liberian Maritime Law and Regulations

## 2.0 STEAM PROPULSION PLANT

- 2.1 Applied Heat; (Thermodynamics & Heat Transmission); Applied Mechanics and Hydromechanics

### Boilers

- 2.2 General Construction, Steam Drum Fittings; Furnace Construction, Linings and Repairs
- 2.3 Superheaters and Desuperheaters
- 2.4 Safety Valves
- 2.5 Air Heaters and Economizers
- 2.6 Sootblowers
- 2.7 Forced Draft Systems; Burners and Fuel Systems; Air Registers; Fuel Combustion Process and Control Systems
- 2.8 Water Level Indicators and Feed Water Level Control
- 2.9 Boiler Water Testing and Treatment
- 2.10 Raising Steam and Coupling Boilers; Maneuvering
- 2.11 Surveys, Repairs and Maintenance; Engineering Administration and Liberian Maritime Law and Regulations

### Low Pressure Feed Systems

- 2.12 Condensers; Drain Tank and Make-up System; Filters

### High Pressure Feed Systems

- 2.13 Feed Pumps; Salinity Indicator; Air Ejectors; Feed Heaters; Deaerators

### Turbines - Propulsion

- 2.14 General Construction; Flexible Couplings; Gearing
- 2.15 Blading Types; Velocity and Pressure Compounding; Nozzle Control
- 2.16 Thrust Bearing; Bearings; Lubricating Oil System
- 2.17 Maneuvering; Local and Remote Control; Gland Steam System; Astern Running
- 2.18 Overspeed Control; Vibration Meter; Emergency Operations
- 2.19 Turning Gear; Warming-through Procedure; Prolonged Operation at Lower Power/low Vacuum
- 2.20 Bleed Steam Utilization

### **3.0 AUXILIARY POWER PLANT**

- 3.1 Electrical Theory; Machinery Drawing
- 3.2 Diesel Alternators
- 3.3 Switchboards and Switch Gear
- 3.4 Electric Motors
- 3.5 Emergency Diesel Systems
- 3.6 Emergency Power Battery Systems
- 3.7 Turbo Alternators
- 3.8 Open Feed Systems; Auxiliary Boilers
- 3.9 Electrical Supply Systems
- 3.10 Steam and Exhaust Systems
- 3.11 Properties of Fuel Oils
- 3.12 Fuel Oil Transfer Systems; Bunkering
- 3.13 Automation, Instrumentation, and Control Systems
- 3.14 Shore Power Operation
- 3.15 D.C. Generators
- 3.16 Flameproof and Intrinsically Safe Equipment
- 3.17 Fluorescent Lighting
- 3.18 Rectifiers and Invertors
- 3.19 Electronics and Logic
- 3.20 Steam-to-Steam Generators

### **4.0 AUXILIARY MACHINERY AND EQUIPMENT**

- 4.1 Applied Mathematics; Refrigeration Theory; Naval Architecture
- 4.2 Air Compressors and Compressed Air Systems
- 4.3 Evaporators
- 4.4 Electrically and Steam Driven Pumps
- 4.5 Refrigeration; Air Conditioning
- 4.6 Steering Gears
- 4.7 Purifiers and Clarifiers
- 4.8 Temperature and Flow Controllers and Meters
- 4.9 Bilge Systems; Oil Water Separators
- 4.10 Cooling Systems and Heat Exchangers
- 4.11 Blowers and Fan
- 4.12 Incinerators; Sewage Plant
- 4.13 Ballast Systems; Cargo Pump Systems; Cargo Heating Systems
- 4.14 Deck Machinery - Steam, Electric and Hydraulic
- 4.15 Domestic Water and Heating Systems
- 4.16 Inert Gas Systems
- 4.17 Properties of Oils and Greases in General Use
- 4.18 Fire Detection and Alarm Systems; Fixed Fire Fighting Installations

- 4.19 Propellers, Shafting and Stern Seals
- 4.20 Properties of Materials
- 5.0 SAFETY**
  - 5.1 Pollution Avoidance and Control
  - 5.2 Accident Avoidance
  - 5.3 First Aid
  - 5.4 Use of Lifesaving Equipment
  - 5.5 Methods of Damage Control
  - 5.6 Health Hazards
  - 5.7 Use of Tools and Lifting Equipment
  - 5.8 Hot Work Precautions
  - 5.9 Firefighting Equipment
  - 5.10 Confined Spaces Precautions
  - 5.11 Approved Equipment for Hazardous Areas
  - 5.12 Operations in Tankers
  - 5.13 Personal Survival
  - 5.14 Spontaneous Combustion
  - 5.15 Autoignition
  - 5.16 Breathing Apparatus
  - 5.17 Resuscitation
  - 5.18 Electrocution
  - 5.19 "Special Ship" Hazards
  - 5.20 Machinery Overhaul Precautions

## **THIRD/SECOND ASSISTANT ENGINEER**

### **1.0 DIESEL PROPULSION PLANT**

- 1.1 Applied Heat (Thermodynamics & Heat Transmission); Applied Mechanics and Hydromechanics
- 1.2 2 and 4 Stroke Cycles
- 1.3 Scavenging and Supercharging
- 1.4 Fuel System; fuel Combustion Process
- 1.5 Cylinder and Piston Construction; Bearings
- 1.6 Lubrication Systems and Lubricating Oil Treatment
- 1.7 Cooling Systems; Shutting down Engine in Port
- 1.8 Preparation for Starting
- 1.9 Starting and Reversing
- 1.10 Maneuvering
- 1.11 Camshafts and Valve Timing
- 1.12 Chain Drives and Gears
- 1.13 Crankshafts
- 1.14 Scavenge Fires and Crankcase Explosions
- 1.15 Main Engine Condition Monitoring
- 1.16 Exhaust Gas Boilers
- 1.17 Bedplate and Main Frame Construction
- 1.18 Air Inlet and Exhaust Valves
- 1.19 Log Book Entries
- 1.20 Taking Over and Maintaining a Watch



## 2.0 STEAM PROPULSION PLANT

- 2.1 Applied Heat; (Thermodynamics & Heat Transmission); Applied Mechanics and Hydromechanics

### Boilers

- 2.2 General Construction; Gas and Water Flow Paths
- 2.3 Superheaters and Desuperheaters
- 2.4 Safety Valves
- 2.5 Air Heaters and Economizers
- 2.6 Sootblowers
- 2.7 Forced Draft Systems; Burners and Fuel Systems; Air Registers; Fuel Combustion Process and Control Systems
- 2.8 Water Level Indicators and Feed Water Level Control
- 2.9 Boiler Water Testing and Treatment
- 2.10 Raising Steam and Coupling Boilers; Shutting Down Engine in Port
- 2.11 Maneuvering

### Low Pressure Feed Systems

- 2.12 Emergency Operations

### Feed Systems

- 2.13 General Construction and Operation (Condensate System, Condensers, Feed Heaters, Deaerators, Air Ejectors, Feed Pumps, Salinity Indicators, Drain Tank and Make-up System)

### Turbines - Propulsion

- 2.14 General Construction; Flexible Couplings; Gearing
- 2.15 Thrust Bearing; Bearings; Lubricating Oil System
- 2.16 Gland Steam System and Maneuvering
- 2.17 Safety Devices and Emergency Operations
- 2.18 Warming-through Procedure

### Watchkeeping

- 2.19 Plant Condition Monitoring and Log Book Entries
- 2.20 Taking Over and Maintaining a Watch

### **3.0 AUXILIARY POWER PLANT**

- 3.1 Elementary Electrical Theory
- 3.2 Machinery Drawing
- 3.3 Diesel Alternators
- 3.4 Alternators and Generators
- 3.5 Switchboards and Switch Gear
- 3.6 Electric Motors and Starters
- 3.7 Power Transmission
- 3.8 Emergency Power Supplies
- 3.9 Turbo Alternators
- 3.10 Open Feed Systems
- 3.11 Auxiliary and Package Boilers
- 3.12 Exhaust Gas Boilers
- 3.13 Steam and Exhaust Systems
- 3.14 Properties of Fuels and Lubricants
- 3.15 Fuel Oil Transfer Systems and Bunkering
- 3.16 Automation, Instrumentation, and Control Systems
- 3.17 Steam-to-steam Generators
- 3.18 Hydraulic Systems

### **4.0 AUXILIARY MACHINERY AND EQUIPMENT**

- 4.1 Applied Mathematics; Naval Architecture
- 4.2 Air compressors and Receivers
- 4.3 Evaporators
- 4.4 Electrically and Steam Driven Pumps
- 4.5 Refrigeration and Air Conditioning
- 4.6 Steering Gears
- 4.7 Purifiers and Clarifiers
- 4.8 Bilge Systems and Oil Water Separators
- 4.9 Heat Exchangers
- 4.10 Blowers and Fans
- 4.11 Incinerators and Sewage Plant
- 4.12 Ballast and Cargo Pumping Systems
- 4.13 Deck Machinery
- 4.14 Domestic Water Systems
- 4.15 Inert Gas Systems
- 4.16 Cargo Heating Systems
- 4.17 Propeller Shaft Bearings and Glands
- 4.18 Properties of Common Materials
- 4.19 Fire Detection and Alarm Systems; Fixed Fire Fighting Installations
- 4.20 Miscellaneous

## **5.0 SAFETY**

- 5.1 Pollution Avoidance and Control
- 5.2 Accident Avoidance
- 5.3 First Aid
- 5.4 Lifesaving Equipment
- 5.5 Welding and Flamecutting
- 5.6 Health Hazards
- 5.7 Tools and Lifting Equipment
- 5.8 Hot Work Precautions
- 5.9 Firefighting
- 5.10 Confined Spaces Precautions
- 5.11 Approved Equipment for Hazardous Areas
- 5.12 Operations in Tankers
- 5.13 Personal Survival
- 5.14 Spontaneous Combustion
- 5.15 Autoignition
- 5.16 Breathing Apparatus
- 5.17 Resuscitation
- 5.18 Electrocutation
- 5.19 "Special Ship" Hazards
- 5.20 Machinery Overhaul Precautions

### **III. EXAMINATION PROCEDURES**

Examinations are administered on dates mutually agreed upon between candidates and the test center. Candidates will receive confirmation in writing as to the date and location arranged for examination. The written examination takes three days in the case of candidates for diesel or steam certificates and four days in the case of candidates for combined licenses. Figure 1 gives the schedule of the written examinations.

The complete engineer officer's examination consists of five parts, viz. diesel propulsion plant, steam propulsion plant, auxiliary power plant, auxiliary machinery and equipment, and safety. The examination is offered in three versions: diesel only, steam only, and combined. The former have four papers each, with a total of two hundred questions, and the combined examination has five papers, with a total of two hundred and sixty questions.

The examination is closed book; that is, candidates may not use books, notes, or other reference materials. They may use non-programmable calculators and their own dictionaries if they wish.

Candidates may not communicate with each other during the examination. Any candidate who communicates with an unauthorized person, or uses unauthorized materials, will be dismissed from the examination and be considered to have failed the entire examination. Candidates failing under these circumstances will not be eligible for re-examination for a period of six months.

Candidates will normally be advised of their results within one calendar month. Candidates must obtain 70% in each of the parts in order to pass the examination. Candidates failing one or more parts must arrange to be re-examined in the subject(s) failed, and obtain 70% in order to receive certification. Figure 2 summarizes the re-examination procedure.

### **IV. THE MULTIPLE-CHOICE EXAMINATION FORMAT: GENERAL ADVICE**

The examination format is multiple-choice. Each question has four possible answers, and the candidate must blacken the space on the answer sheet which corresponds to the letter of the answer considered most appropriate. A candidate's score is determined by the number of questions answered correctly. All questions have the same value. Candidates are advised to answer each question as well as they can and not to spend too much time on any one question. Candidates not knowing the answer to a question should leave it blank and go on to the next question. If time is left after finishing the rest of the questions, the candidate can go back to the questions left blank and try to answer them.

## FIGURE 1

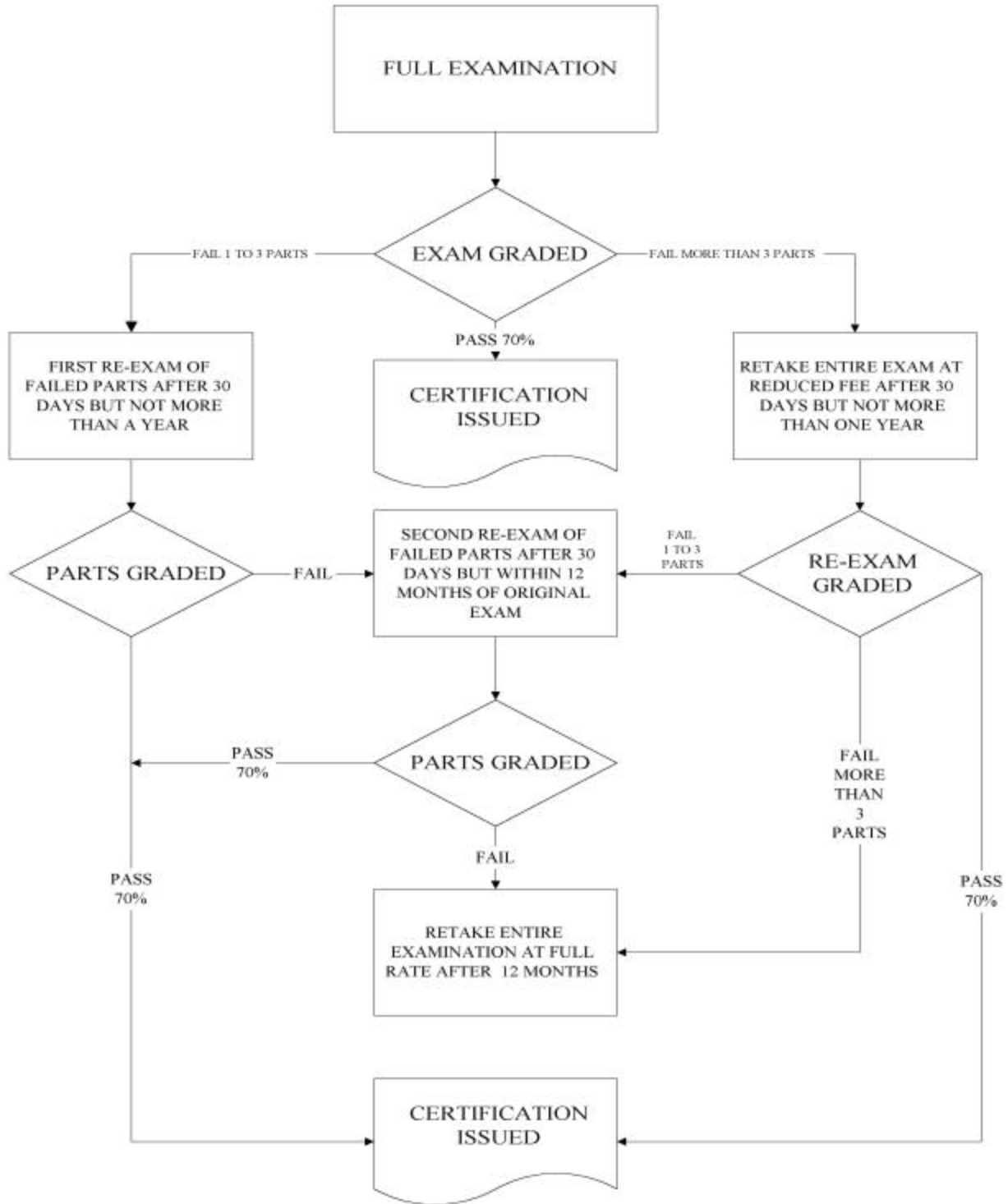
### TIME TABLE FOR ENGINEER OFFICERS' WRITTEN EXAMINATION PAPERS

DAY 1	DAY 2	DAY 3	DAY 4
Candidates promptly report at 0900			
0930 - 1200 Diesel	0930 - 1200 Aux. Power Plan	0930 - 1200 Aux. Machinery	0930 - 1200 Steam
1200 - 1330 Lunch	1200 - 1330 Lunch	1200 - 1330 Lunch	1200 - 1330 Lunch
1330 - 1600 Diesel	1330 - 1500 Aux. Power Plant	1330 - 1600 Aux. Machinery	1330 - 1600 Steam
Part II 30 Q Time 2½ hrs	Part II 20 Q Time: 1 ½ hrs	Part II 30 Q Time: 2 ½ hrs	Part II 30 Q Time: 2 ½ hrs

Interval 20 mins.

1520 - 1650  
Safety 30 Q  
Time: 1 ½ hrs

**FIGURE 2  
RE-EXAMINATION PROCESS**



## **V. USING THE ANSWER SHEET**

A specimen of the examination answer sheet is shown in figure 3. The candidate must mark all answers on a sheet like this. No credit will be given for anything marked in the examination booklet. The candidate should not make any notes, calculations, or extra marks on the answer sheet. Doing so may affect computer grading and void the examination results. The candidate must NOT fold the answer sheet.

The answer spaces are lettered a, b, c, and d, like the answers in the examination booklet. The candidate will use the No. 2 pencil provided to fill in the space marked with the letter corresponding to the letter of the answer judged best. The candidate should be sure that the answer is filled in completely. **IF THE CANDIDATE CHANGES THE ANSWER, THE FIRST CHOICE MUST BE ERASED COMPLETELY AND THE NEW ANSWER MARKED.** No credit will be given for questions with what would appear to have more than one answer marked.

# EXAMINATION ANSWER SHEET

USE NO. 2 PENCIL ONLY

- Make clean erasures.
- Make NO stray marks.
- Do NOT fold.

Signature James Smith

Section Number 1 Grade of Examination 3M

PRINT LAST (FAMILY) NAME

S	M	I	T	H
---	---	---	---	---

PRINT FIRST (GIVEN) NAME

J	A	M	E	S
---	---	---	---	---

EXAM CENTER

0	0	1
0	1	2
2	3	4
4	5	6
6	7	8
8	9	0

EXAM NUMBER

0	0	4	5	6	7	8
0	1	2	3	4	5	6
2	3	4	5	6	7	8
4	5	6	7	8	9	0
6	7	8	9	0	1	2
8	9	0	1	2	3	4

EXAM BOOK NUMBER

1	2	3	4	0	1
0	1	2	3	4	5
2	3	4	5	6	7
4	5	6	7	8	9
6	7	8	9	0	1
8	9	0	1	2	3

DATE

MONTH	DAY	YEAR
1	0	2
0	1	3
2	3	4
4	5	6
6	7	8
8	9	0

SECTION

1
0
1
2
3
4
5
6
7
8
9

CODE (RESERVED)

1	2	3	4	5	6	7	8	9	0
0	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	0
2	3	4	5	6	7	8	9	0	1
3	4	5	6	7	8	9	0	1	2
4	5	6	7	8	9	0	1	2	3
5	6	7	8	9	0	1	2	3	4
6	7	8	9	0	1	2	3	4	5
7	8	9	0	1	2	3	4	5	6
8	9	0	1	2	3	4	5	6	7
9	0	1	2	3	4	5	6	7	8

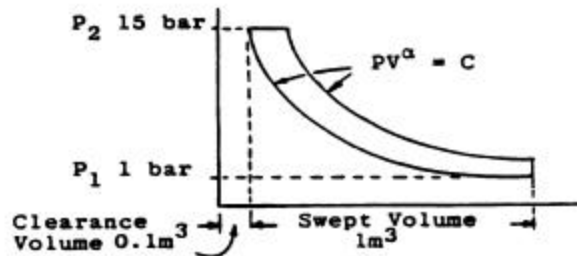
1	A	B	C	D	21	A	B	C	D	41	A	B	C	D
2	B	C	D	A	22	A	B	C	D	42	A	B	C	D
3	A	B	C	D	23	A	B	C	D	43	A	B	C	D
4	A	B	C	D	24	B	C	D	A	44	A	B	C	D
5	B	C	D	A	25	A	B	C	D	45	A	B	C	D
6	A	B	C	D	26	A	B	C	D	46	A	B	C	D
7	A	B	C	D	27	A	B	C	D	47	A	B	C	D
8	A	B	C	D	28	A	B	C	D	48	A	B	C	D
9	B	C	D	A	29	A	B	C	D	49	A	B	C	D
10	B	C	D	A	30	B	C	D	A	50	A	B	C	D
11	A	B	C	D	31	A	B	C	D	51	A	B	C	D
12	A	B	C	D	32	A	B	C	D	52	A	B	C	D
13	B	C	D	A	33	A	B	C	D	53	A	B	C	D
14	A	B	C	D	34	A	B	C	D	54	A	B	C	D
15	A	B	C	D	35	A	B	C	D	55	A	B	C	D
16	A	B	C	D	36	A	B	C	D	56	A	B	C	D
17	B	C	D	A	37	A	B	C	D	57	A	B	C	D
18	A	B	C	D	38	A	B	C	D	58	A	B	C	D
19	A	B	C	D	39	A	B	C	D	59	A	B	C	D
20	A	B	C	D	40	A	B	C	D	60	A	B	C	D



## VI. SAMPLE QUESTIONS WITH ANSWER KEY

### 1.0 Diesel Propulsion Plant

- . 1 What is the compression ratio in this cycle?



- a. 15 to 1  
b. 10 to 1  
c. 11 to 1  
d. 16 to 1
- . 2 In the event of a scavenge fire which does not appear severe, what should be done?
- a. slow down engine, shut off fuel to affected cylinder and increase cylinder lubrication.  
b. shut off fuel and lubrication to affected cylinder.  
c. maintain engine speed and open fire extinguishing system to scavenge box.  
d. stop the engine and allow the fire to burn itself out.
- . 3 The alarm of a diesel engine oil must detector is set at
- a. the lower explosive limit.  
b. the upper explosive limit.  
c. 50 percent of the upper explosive limit.  
d. about 5 percent of the lower explosive limit.
- . 4 What do you call an exhaust turbocharging system in which allowed cylinders exhaust into a common exhaust manifold before the turbine entry?
- a. a tuned system.  
b. a pulse system.  
c. a constant pressure system.  
d. a uniflow system.
- . 5 What fluid is circulated through main engine cylinder liners to keep them cool?
- a. compressed air  
b. sea water  
c. fresh water

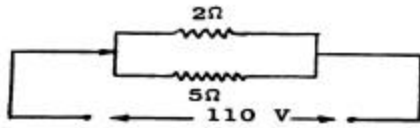
d. lubricating oil

## 2.0 Steam Propulsion Plant

- . 1 A boiler produces 5000 kg/hr (11,000 lbs/hr) of 96% dry steam at a gauge pressure of 700 kN/m<sup>2</sup> (100 psi) and a feed water temperature of 40 degrees Celsius (105 degrees Fahrenheit). The boiler burns 590 kg/hr (1,300 lbs/hr) of coal with a calorific value of 3,100 kJ/kg (13,500 BTU/lb.) What is the efficiency of the boiler where the heat content of the steam (kg) is 272.6 kJ/kg (1187.2 BTU/lb) and that of the feedwater (hp) is 16.7 KJ/kg (72.7 BTU/lb)?
  - a. 55.5%
  - b. 67.6%
  - c. 60%
  - d. 50.3%
  
- . 2 The feed inlet temperature to economizers is maintained above 138°C (280°F), in order to
  - a. prevent external corrosion of the economizer.
  - b. reduce thermal shocking of the boiler.
  - c. improve thermal efficiency.
  - d. prevent cavitation damage to feed pump impellers.
  
- . 3 To eliminate chokage, corrosion and fires, the air heater fitted to a boiler should be
  - a. a rotary gas-air heater with ceramic elements.
  - b. a tubular gas-air heater with a glass coating.
  - c. a steam-air heater with finned tubes.
  - d. a tubular gas-air heater with plain vertical tubes.
  
- . 4 What do you do to obtain maximum efficiency at low turbine power?
  - a. open all the nozzles and throttle the main steam supply valve.
  - b. keep the main steam supply valve full open and fully open a limited number of nozzles.
  - c. open all nozzles fully and reduce the vacuum to obtain the desired power.
  - d. keep the main steam supply valve full open and throttle all the nozzles simultaneously.
  
- . 5 What would cause loss of vacuum in a condenser associated with an increase in undercooling?
  - a. incorrect operation of the air ejector.
  - b. blocked condenser tubes.
  - c. dirty condenser tubes.
  - d. overloading of the condenser.

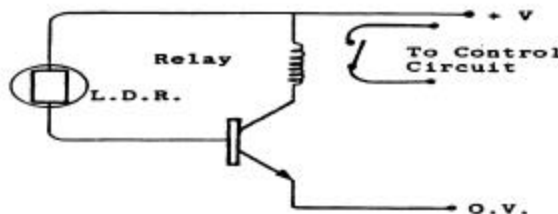
### 3.0 AUXILIARY POWER PLANT

- . 1 What is the total current drawn by this circuit?



- a. 77 amps
  - b. 7 amps
  - c. 15.7 amps
  - d. 157.1 amps
- . 2 What does an automatic voltage regulator (avr) do, in addition to keeping the output voltage at the rated value?
- a. ensures equal sharing of the KW load when alternators operate in parallel.
  - b. ensures equal sharing of the KVAR load when alternators operate in parallel.
  - c. controls the overall system load power factor.
  - d. ensures that alternators in parallel always run at equal speed.
- . 3 Main switchboard preference trips are set to operate at successive intervals of
- a. 5 seconds.
  - b. 20 seconds.
  - c. 60 seconds.
  - d. 1-2 seconds.

- . 4 In the flame failure of the light (L.D.R.) to

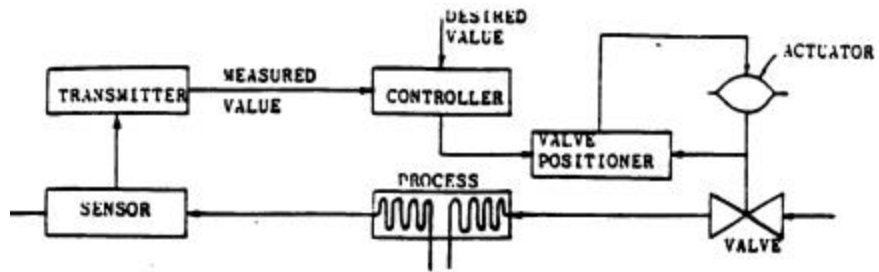


failure circuit shown, flame would cause the dependent register

- a. remove the short circuit from the relay.
- b. be connected in parallel with the relay.
- c. reduce the base current to the transistor.
- d. reverse the control circuit voltage polarity.



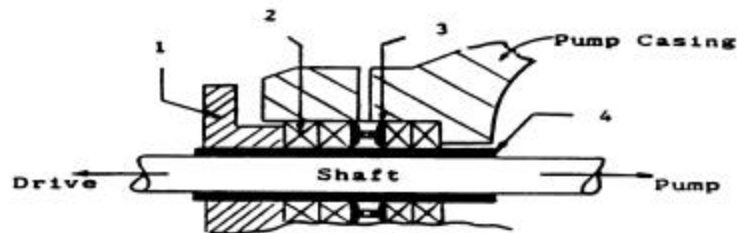
- . 5 The diagram represents an automatic control loop. An auto/manual system is normally fitted into the loop so that the system can be controlled manually under certain conditions. Where would the auto/manual station in this loop be located:



- between the transmitter and the controller.
- between the controller and the valve positioner.
- between the valve positioner and the valve actuator.
- between the process and the controller.

#### 4.0 Auxiliary Machinery and Equipment

- . 1 When two refrigerator compressors are running in parallel, what is it essential to check regularly?
  - a. the individual expansion valve settings.
  - b. the cooling water flows to the separate condensers.
  - c. the individual gas suction temperatures.
  - d. the lube oil levels in the separate compressors.
  
- . 2 What process disposes of solid waste material in the secondary chamber of an incinerator?
  - a. polymerization.
  - b. pyrolysis.
  - c. pyrography.
  - d. plasma reduction.
  
- . 3 Before putting an oil water separator into operation, what should you do?
  - a. ensure it is filled with clean sea water.
  - b. drain it completely.
  - c. pressurize the upper chamber with air at 5 lb/in<sup>2</sup> (0.35 bar).
  - d. flush it through to the sea.
  
- . 4 When indicating a small leak in a Freon refrigeration system, the flame color of a halide leak detector torch will change from
  - a. pale blue to green.
  - b. green to pale blue.
  - c. white to violet.
  - d. red to green.
  
- . 5 In the packing gland shown below, which number indicates a lantern ring?



- a. 1.
- b. 2.
- c. 3.
- d. 4.



## 5.0 SAFETY

- . 1 Cardio-pulmonary resuscitation (CPR) is a combination of
  - a. mouth-to-mouth resuscitation and rhythmic depression of the patient's chest.
  - b. mouth-to-mouth resuscitation and intravenous injection of saline solution.
  - c. rhythmic depression of a patient's chest and application of suitable smelling salts.
  - d. mechanical resuscitation and injection of a heart stimulant.
  
- . 2 What will a small portable fire extinguisher colored green contain?
  - a. carbon dioxide.
  - b. halon gas.
  - c. purple K dry powder.
  - d. foam.
  
- . 3 When workers are spray painting in a confined space, what should they wear?
  - a. goggles.
  - b. goggles, gloves and protective shoes.
  - c. goggles and respirator.
  - d. full face masks and gloves.
  
- . 4 Which of the following fire extinguishers could safely be injected into a space still occupied by personnel?
  - a. carbon dioxide.
  - b. inert gas.
  - c. high expansion foam.
  - d. nitrogen.
  
- . 5 What can you do as first aid if someone receives a severe burn?
  - a. bandage the burn tightly to keep out the air.
  - b. cover the burn with grease or oil.
  - c. pour cold fresh water over the burn for 30 minutes.
  - d. cool the wound with compressed air.

## Answer Key

### Section 1 - Diesel Propulsion Plant

- .1 c
- .2 a
- .3 d
- .4 c
- .5 c

### Section 2 - Steam Propulsion Plant

- .1 b
- .2 a
- .3 c
- .4 b
- .5 a

### Section 3 - Auxiliary Power Plant

- .1 a
- .2 b
- .3 a
- .4 c
- .5 b

### Section 4 - Auxiliary Machinery and Equipment

- .1 d
- .2 b
- .3 a
- .4 a
- .5 c

### Section 5 - Safety

- .1 a
- .2 b
- .3 c
- .4 c
- .5 c

Note: Section 1 - Diesel Candidates only.

Section 2 - Steam Candidates only.  
Section 3, 4 and 5 - All Candidates

## VII. BIBLIOGRAPHY AND SUPPLIERS

When purchasing books, candidates are advised to buy only the latest printings and editions.

### Chief Engineer and First Assistant Engineer Candidates

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Flanagan, G.T.H. **Feed System and Treatment.** Marine Engineering Series. London: Stanford Maritime

He, S.H. **Medium and High Speed Diesel Engines for Marine Use.** London: Institute of Marine Engineers, 76 Mark Lane, London EC3R, 7JN.

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Kraal, E.G.R. **Basic Electrotechnology.** Reeds Marine Engineering Series, Vol. 6. London: Thomas Reed Publications.

**Marine Engineering Practice.** Vol. 1, Parts 2-9. London: Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN

**Marine Engineering Practice.** Vol. 2, Parts 13-18. London: Institute of Marine Engineers.

McBirnle, S.C., and Fox, W.J. **Marine Steam Engines and Turbines.** Borough Green, England: Newnes-Butterworths, Borough Green, Sevenoaks, Kent TN 15 8PH, UK.

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Souchette, E., and Smith, D.C. **Marine Auxiliary Machinery.** Marine Engineering Series. Borough Green, England: Butterworth & Co.

Woodward, J.B. **Low Speed Marine Diesels**. New York: Wiley Interscience, 605 Third Avenue, New York, NY 10158, USA.

### **THIRD ASSISTANT ENGINEER AND SECOND ASSISTANT ENGINEER CANDIDATES**

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Embleton, W. **Heat and Heat Engines**. (SI Units). Reeds Marine Engineering Series, Vol. 3. London: Thomas Reed Publications.

Embleton, W. **Mathematics**. Reeds Practical Mathematics Series, Vol. 1. London: Thomas Reed Publications.

Kemp, J.F. and Young, P. **Electricity and General Magnetism**. Kandy Series. London: Stanford Maritime, 12-14 Long Acre, London WC2E 9LP, UK.

**Marine Engineering Practice**. Vol. 1. Part 7. **Slow Speed Diesel Engines**. London: Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN, UK.

**Marine Engineering Practice**. Vol. 2. Part 8. **Marine Steam Turbines**. London: Institute of Marine Engineers.

McGeorge, H.D. **General Engineering Knowledge**. London: Stanford Maritime, 12-14 Long Acre, London WC2E 9LP, UK.

Morton, T.D. **Steam Engineering Knowledge**. Reeds Marine Engineering Series, Vol. 9. London: Thomas Reed Publications, 36 Cock Lane, London EC1A 9BY, UK.

Morton, T.D. **Motor Engineering Knowledge**. Reeds Marine engineering Series, Vol. 4. London: Thomas Reed Publications.

Stokoe, E.A. **Naval Architecture**. Reeds Marine Engineering Series, Vol. 4. London: Thomas Reed Publications.

Stokoe, E.A. **Ships Construction**. Reeds Marine Engineering Series, Vol. 5. London: Thomas Reed Publications.

**NOTE:** These books may be obtained directly or by mail order from good nautical bookstores and many chart agents. There are some additional sources which candidates may wish to use:

- Institute of Marine Engineers publications should be obtained from Marine Management (Holdings) Ltd., which stocks institute publications and many others. The address is 76 Mark Lane, London EC3R 7JN, UK.
- IMO publications are seldom stocked abroad, and should be obtained directly from the International Maritime Organization, Publication Section, 4 Albert Embankment, London SE1 7SR, UK.
- ILO publications may be obtained through Unipub, P.O. Box 433, Murray Hill Station, New York, NY 10157 , USA.
- British government publications may be obtained from the Government Bookshop, Her Majesty's Stationery Office, P.O. Box 569, London SE1 9NH, UK.
- American government publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, USA.

Missions to seamen, coast guard schools, and similar institutions frequently supply up-to-date, well-illustrated notes and booklets on all facets of the nautical profession. Candidates are encouraged to use all these resources to obtain books which they personally find easy to read and understand. They should use only **CURRENT EDITIONS** and up-to-date materials.

Liberian Services, Inc. does not distribute books or recommend suppliers.

### VIII. TABLE OF SI AND IMPERIAL UNITS AND CONVERSION FACTORS

PHYSICAL QUALITY	SI METRIC UNITS	IMPERIAL UNITS <b>FT - LB -S</b>	CONVERSION FACTORS
Length	meter (m)	foot (ft)	1 m = 3.281 ft
Mass	kilogramme (kg)	pound (lb)	1 kg = 2.205 lb
Time	second(s)	second(s)	N/A
Temperature (interval)*	°C	°F	N/A
Specific Volume	m <sup>3</sup> /kg	ft <sup>3</sup> /lb	1m <sup>3</sup> /kg = 16.02ft <sup>3</sup> /lb
Force	newton(N)	poundle (pdl)	1 N = 7.233 pdl = .2248 lbf
Pressure	N/m <sup>2</sup> or bar	poundle per square foot (pdl/ft <sup>2</sup> )	1 bar = 10 <sup>5</sup> N/m <sup>2</sup> = 14.5 lbf/in <sup>2</sup>
Energy	joule (J) or kJ	foot poundle (ft pdl)	1 J = 1 Nm - 0.738 ft lbf
Rate of Energy Flow	watt (W) or kW	foot poundle per second (ft pdl/s)	1W = 1 J/s = 0.738 ft lbf/s

\*Note: Degrees Celsius (°C) and Fahrenheit (°F) will be used for examination purposes, rather than degrees Kelvin (°K) and Rankin (°R) which are the respective standards for the two systems.

## **IX. ENGLISH LANGUAGE PROFICIENCY EXAMINATION**

Candidates for Third Assistant and Second Assistant Engineer who take the examination in a language other than English, must demonstrate competence in the use and understanding of English in written and oral form through examination and assessment of evidence obtained from practical instruction administered by the proctor for the examination.

The engineer officer examination is designed to allow the candidate to demonstrate an adequate knowledge of the English language to enable the officer to use engineering publications, to understand information concerning ship's safety and operation, and to perform the engineering duties with a multilingual crew.

The examination involves two parts. The first part consists of 30 questions on various maritime situations which test understanding of vocabulary and the use of standard marine communication phrases, idiomatic expressions and grammar skills. The second part consists of 20 questions given verbally by the proctor administering the examination which requires the candidate to understand and respond correctly to the questions put to him. Passing grade is 70%.



## X. SAMPLE QUESTION WITH ANSWER KEY

### 1.0 English Language

- . 1 The engineer on watch \_\_\_\_\_ the general alarm when the lube oil \_\_\_\_\_ fire.
- a. ringed . . . caught
  - b. rang . . . caught
  - c. ring . . . catch
  - d. ringed . . . is catching
- . 2 The fire was \_\_\_\_\_ out of control when the shore-side fire party \_\_\_\_\_ .
- a. burned . . . arriving
  - b. burning . . . arrives
  - c. burned . . . arrives
  - d. burning . . . arrived
- . 3 The fire \_\_\_\_\_ the bulkhead to the point that the paint was \_\_\_\_\_ .
- a. heat . . . blisters
  - b. heats . . . blistered
  - c. heated . . . blistered
  - d. heated . . . blister
4. The anchor is on the \_\_\_\_\_ .
- a. bow
  - b. deck
  - c. bridge
  - d. pump room
5. The highest ranking engineering officer is the \_\_\_\_\_ .
- a. captain
  - b. chief engineer
  - c. first engineer
  - d. first mate

## 2.0 ORAL QUESTIONS

1. Your next watch is 0800 to 1200. It is now 2350 on June 1. This means that your next watch is when?
  - a. tonight.
  - b. yesterday.
  - c. tomorrow.
  - d. later today.
  
2. If the anchor windlass was broken what would you do?
  - a. fix it.
  - b. fixes it.
  - c. break it.
  - d. breaking it.
  
- . 3 The main advantage of a steady stream of water on a class "A" fire is that it breaks up and cools the fire. A steady stream would be one that is:
  - a. intermittent.
  - b. colder.
  - c. continuous.
  - d. misty.
  
- . 4 What changes the speed ratios or directions of moving shafts?
  - a. Gears.
  - b. Axles.
  - c. Keyways.
  - d. Slots.
  
5. What is the cooling medium in a refrigeration system?
  - a. water.
  - b. freon.
  - c. methane.
  - d. anti-freeze.

Answer Key

Section 1 - English Language

- .1 b
- .2 d
- .3 c
- .4 a
- .5 b

Section 2 - Oral Questions

- .1 c
- .2 a
- .3 c
- .4 a
- .5 b