

- (b) Fishing Boats (Certificate of Competency) First Class and Second Class Engineers Regulations, 1974.

L.I. 988

ARRANGEMENT OF PARAGRAPHS

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IN exercise of the powers conferred on the Commissioner by section 19 of the Fisheries Decree, 1972 (N.R.C.D. 87) this Instrument is made this 19th day of November, 1974.

Qualification
of candi-
dates.

1. (1) No person shall qualify to enter the examination for a Certificate of Competency, Second Class Engineer (Fishing), unless—

- (a) he has attained the age of 21 years;
- (b) he possesses a medical certificate for soundness of hearing and speech;
- (c) subject to paragraph 5 of these Regulations he satisfies the requirements in paragraph 2 or 4 of these Regulations; and
- (d) he has performed two years sea service, twelve months of which has been spent on regular watch on the main propelling machinery.

(2) No person shall qualify to enter the examination for a Certificate of Competency, First Class Engineer (Fishing), unless—

- (a) he has attained the age of 23 years;
- (b) he possesses a recognised Second Class Engineers (Fishing) Certificate of Competency;
- (c) he has performed two years sea service after obtaining the qualification in clause (b) of this sub-paragraph, two-thirds of which was spent at sea in full charge of a watch; and
- (d) he possesses a medical certificate for soundness of hearing and speech.

Workshop
service.

2. Except as provided for in paragraphs 4 and 5 of these Regulations a candidate for the examination in sub-paragraph (1) of paragraph 1 shall satisfy the following requirements:—

- (a) the candidate should have performed eighteen months service as apprentice engineer, six months of which must have been devoted to fitting, erecting or repairing machinery suitable for training of Marine Engineers on fishing vessels;
- (b) the candidate must have spent the remaining twelve months service either on the jobs specified in paragraph 2 (a) or on any combination of the following jobs so however that he shall not exceed the maximum period indicated for each job:—
 - (i) six months service of metal turning;

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- (ii) four months service of boiler making or repairing of boiler;
- (iii) three months service of pattern making;
- (iv) four months service of planning, slotting, shaping and milling;
- (v) six months approved schemes of training in the use of hand and small machine tools;
- (vi) three months service on smithywork;
- (vii) three months service on coppersmithy;
- (viii) three months service on welding;
- (ix) three months service in the drawing office;
- (x) six months service on electrical work of a substantial nature; and
- (xi) three months service on instruments and distant gear fitting.

3. (1) Every candidate for the Second and First Class Engineers Certificate of Competency (Fishing) shall produce workshop service testimonials as in the form prescribed in the First Schedule to these Regulations. Testimonials for workshop and sea service.

(2) Subject to sub-paragraph (1) of this paragraph every candidate for the Second Class Engineers Certificate of Competency examination shall accompany his application for the examination with a testimonial in the form prescribed in the First Schedule to these Regulations.

(3) The testimonial shall state clearly the period actually spent at sea.

(4) Where service at sea falls below two-thirds of the whole period the examiner may require the candidate to do additional sea service to make up for the deficiency.

(5) Every candidate for the First Class Engineers Certificate of Competency examination shall produce a testimonial in the form prescribed in the First Schedule to these Regulations.

4. A candidate who has undergone a full-time course at the Ghana Nautical College or any other approved institution shall be exempted from the provisions of paragraph 2 of these Regulations, provided he holds a certificate of proficiency, ability and good conduct from the competent authorities of the institution concerned. Full-time Technical College and other approved courses.

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Compensa-
tory service.

5. (1) A candidate, who is deficient in workshop service, shall in addition to the qualifying service set out in sub-paragraph (1) (d) of paragraph 1 of these Regulations, perform further service at sea in respect of regular or day work at sea.

(2) The time spent for further service under sub-paragraph (1) of this paragraph shall be accepted as having half the value of suitable workshop service subject to a maximum of six months workshop service.

Disqualified
persons.

6. No person who has been found guilty of desertion or gross misconduct on board a ship shall be allowed to enter the examination for the Second or First Class Engineers Certificate of Competency (Fishing).

Application-
for exami-
nation.

7. (1) Any person qualified to enter the examination for a First Class or Second Class Engineers Certificate of Competency (Fishing) shall complete Form EXN.G. 3 prescribed in the Second Schedule to these Regulations.

(2) All completed forms together with such certificates, testimonials and other supporting documents required by these Regulations shall be addressed to the Examiner and should reach the examinations office within ten days before the date of the examination.

Places and
days for
examination.

8. The Commissioner shall by notice published in the *Gazette* designate centres and dates for the examinations.

Appoint-
ment of
examiners.

9. All examinations shall be conducted by officers appointed as Examiners of Engineers and in the absence of such examiners, the examination shall be conducted by such officers as the Commissioner may appoint.

Subjects
and syllabuses for
the exami-
nation.

10. (1) The examination for the Second and First Class Engineers Certificate of Competency (Fishing) shall be in two parts namely, Parts A and B.

(2) Parts A and B of the examination in the Second Class Engineers Certificate of Competency (Fishing) shall consist of the subjects specified in the syllabus set out in the Third Schedule to these Regulations.

(3) Parts A and B of the examination in the First Class Engineers Certificate of Competency (Fishing) shall consist of the subjects specified in the syllabus set out in the Fourth Schedule to these Regulations.

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11. A candidate may take both Parts A and B of either the Second or First Class Engineers Certificate of Competency (Fishing) examination at the same time or take each part at separate sittings, provided the following requirements are met:--

Procedure
for examina-
tion.

- (a) a candidate for the Second Class Engineers Certificate of Competency (Fishing) shall, before presenting himself for the Part A examination, satisfy the requirement in respect of workshop service set out in paragraph 2 of these Regulations;
- (b) a candidate for Part B of the Second Class Engineers Certificate of Competency (Fishing) may present himself for this examination at any time, provided he complies with the requirements in sub-paragraphs (1) (c) and (d) of paragraph 1 of these Regulations and provided also that he enters for the Part A examination at the same time or has either completed that examination or has been exempted from it;
- (c) a candidate for Part A of the First Class Engineers Certificate of Competency (Fishing) may at any time after obtaining the Second Class Engineers Certificate of Competency (Fishing) present himself for the examination;
- (d) to obtain a pass in Part A the candidate must be successful in the mathematics and engineering papers at the same sitting;
- (e) a candidate for Part B of the First Class Engineers Certificate of Competency (Fishing) may at any time present himself for this examination provided he complies with the requirements set out in sub-paragraph (2) of paragraph 1 of these Regulations and provided also that he enters for the Part A examination at the same time or has either completed that examination or has been exempted from it.

12. (1) Any candidate who enters for any part of the examination shall be notified of the results.

Results of
examina-
tions.

(2) Where a candidate passes in both parts of the examination he shall be notified of the results by the examiner in Form EXN.G.16 prescribed in the Fifth Schedule to these Regulations.

(3) A candidate who receives the notification form prescribed in sub-paragraph (2) of this paragraph shall submit the Form to the Ministry of Transport and Communications (Division of Shipping and Navigation).

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(4) The Ministry on receiving the notification form prescribed in the Fifth Schedule shall grant a Certificate of Competency as a Second or First Class Engineer (Fishing) to the candidate presenting it.

(5) Where a candidate fails in one or both parts of the examination he shall be notified of the results by the examiner in Form EXN.G. 18 prescribed in the Sixth Schedule to these Regulations.

Re-examina-
tion.

13. (1) A candidate for Part A of the Second Class Engineers Certificate of Competency (Fishing) examination, who is successful in one subject only shall enter for all the subjects when he applies for re-examination.

(2) Where a candidate is successful in two subjects he may be exempted from those subjects and shall enter for the subject in which he is not successful.

(3) A candidate for Part B of the Second Class Engineers Certificate of Competency (Fishing) examination, who passes in one or more of the papers in Electrotechnology, Refrigeration or Engineering knowledge may be required to take the examination in the papers in which he is not successful.

(4) A candidate for Part B of the First Class Engineers Certificate of Competency (Fishing) examination, who passes in one or more of the papers in Electrotechnology, Refrigeration or Engineering knowledge may be required to take the examination again in the papers in which he is not successful.

(5) Where as a result of inadequate practical knowledge a candidate fails in the Engineering knowledge paper or the oral part that candidate may be required to perform a further service at sea for a period not exceeding six months before entering for re-examination.

(6) A candidate for the Second or First Class Engineers Certificate of Competency (Fishing) examination, who successively fails three times in either Part A or B, may be debarred for a period not exceeding three months from entering for re-examination.

(7) A candidate who allows a period of twelve months or more to elapse after passing any of the papers in any part of the examination shall be required to take the whole examination in that part again.

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14. (1) Any candidate who has passed an examination recognised by the Commissioner before the coming into force of these Regulations shall be entitled to a grant of a Second or First Class Engineers Certificate of Competency (Fishing). Issue of certificates in special cases.

(2) The provisions of paragraph 18 of these Regulations shall not apply to a candidate who is granted a certificate under sub-paragraph (1) of this paragraph.

15. (1) Any candidate who produces satisfactory evidence that he has completed a full-time course of instructions at the Ghana Nautical College and has passed the examination conducted at the end of the course may be granted exemption from Part A and papers 1 and 2 of the Part B examination for a Second Class Engineers Certificate of Competency (Fishing). Exemptions.

(2) A candidate other than the one referred to in sub-paragraph (1) of this paragraph who has completed a similar course at other institutions may be granted exemption on subject to subject basis, provided he produces satisfactory evidence to that effect.

(3) A candidate may be granted exemption in any of the subjects in the First Class Engineers Certificate of Competency (Fishing) except engineering knowledge paper of Part B if he produces sufficient evidence that he has attained the required standard in the subject from which he seeks exemption.

(4) Subject to sub-paragraph (3) of this paragraph no exemption shall be granted to any candidate in the First Class Engineers Certificate of Competency (Fishing) examination.

16. (1) A candidate whose Certificate of Competency is lost or destroyed shall forthwith notify the examiner on Form EXN.G. 23 prescribed in the Seventh Schedule to these Regulations. Loss of certificate.

(2) If the examiner satisfies himself that the certificate is lost or destroyed he shall forward the form to the Ministry to issue a copy of the Certificate of Competency to the holder thereof after the candidate has paid a fee of ₵2.00.

(3) No such fee as prescribed in sub-paragraph (2) of this paragraph shall be paid in respect of a certificate lost through wreckage, loss of a ship or fishing boat or fire on board a ship or fishing boat.

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Offences in connection with forged certificates.

17. (1) Any person who—

- (a) forges or fraudulently alters, or assists in forging or fraudulently altering, or procures to be forged or fraudulently altered, any Certificate of Competency or an official copy of any such certificate, or
- (b) makes, assists in making or procures to be made any false representation for the purpose of procuring either for himself or for any other person a Certificate of Competency, or
- (c) fraudulently uses a certificate or copy of a Certificate of Competency which has been forged, altered, cancelled or suspended, or to which he is not entitled, or
- (d) fraudulently lends his Certificate of Competency or allows it to be used by any other person,

commits an offence and shall be liable on summary conviction to a fine not exceeding $\text{Ø}600.00$ or to imprisonment for a term not exceeding three years or to both.

(2) Any person convicted of an offence under sub-paragraph (1) of this paragraph shall be disqualified from taking any examination conducted under these Regulations.

Fees.

18. The fees prescribed in the Eighth Schedule to these Regulations shall be charged in respect of each examination.

Application.

19. These Regulations shall apply to motor vessels and with such modifications as the Commissioner may prescribe apply to vessels propelled by means other than by diesel engines.

Interpretation.

20. In these Regulations unless the context otherwise requires—

“Certificate of Competency” means a Certificate of Competency Second Class or First Class Engineer (Fishing) issued under the provisions of these Regulations;

“Commissioner” means the Commissioner responsible for Transport and Communications.

“Examiner” means a person appointed examiner under paragraph 9 of these Regulations;

“Ministry” means Ministry responsible for Transport and Communications.

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FIRST SCHEDULE

SPECIMEN FORMS OF TESTIMONIALS

(A) WORKSHOP SERVICE

Name and address of engineering works.....

I CERTIFY THAT the following is a full and true statement of the workshop service performed by Mr..... under my supervision at the above works.

Period of service (Dates)		Total Period	Nature of duties (For appropriate description see below)	Particulars of weekly release periods to permit apprentice to pursue technical studies
From	To			

Report as to ability.....

Report as to conduct.....

Remarks (if any).....

Signature of Employer or his Representative

Description of duties:

- I. (a) Installation or repair of substantial machinery in the machinery spaces of new and existing ships. (Nature of duties must be specified.)
- I. (b) Fitting, erection or maintenance of machinery other than the above suitable for the training of marine engineers. (Nature of duties must be specified.)
- II. Fitting or Machinery other than I
- III. Metal turning
- IV. Machine work (other than lathe)
- V. Work in drawing office, as draughtsman or engineer
- VI. Other work, the nature of which should be specified

The use of the appropriate numerals is sufficient except in cases of I (a), I (b) and VI.

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(B) SEA SERVICE

Name and address of Shipowner or Company

I CERTIFY THAT the following is a full and true statement of the sea service performed by
Mr. under my
supervision on board the O.N.

Period of service (Dates)		Rank of Officer and actual seniority on watch	Type of main engines and boilers, Single or twin-screw.	Nature of duties (For appropriate description see below)
From	To			

During the whole period stated above, Mr.
(a) was granted no leave of absence.
(b) was granted days leave of absence whilst still on articles .

Report as to ability.....

Report as to conduct.....

Report as to sobriety.....

Remarks (if any).....

*Number of days spent at sea.....

.....
Signature of Chief Engineer

.....
*Signature of Engineer, Superintendent or
Master or other Representative of Owners*

*Two-thirds of the period must be spent at sea.

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Description of duties:

- I. On filters's work either by day or regular watch
 - (a) Within main engine and boiler spaces.
 - (b) Outside main engine and boiler spaces.
- II. (a) On refrigerating or other machinery not essential to the propulsion of the vessel.
(b) On auxiliary engines separated from main propelling units but worked in conjunction therewith.
- III. On regular watch† on main engines as
 - (a) First Engine Room Assistant under the Senior in full charge.
 - (b) Second Engine Room Assistant.
 - (c) Junior Engine Room Assistant.
- IV. On regular watch† on main boilers.
 - (a) In charge of all stokeholds.
 - (b) In charge of a section or one stokehold only.
 - (c) As Boiler Room Assistant.
- V. On regular watch† on main engines and boilers simultaneously
 - (a) In full charge of the entire watch.
 - (b) As First Assistant to the Senior in full charge.
 - (c) As Junior Assistant.

Note.—It is recommended that this form should be used when the engineer reported on or when the Chief Engineer, leaves a ship.

†On regular watch means eight hours in every twenty-four hours.

SECOND SCHEDULE

EXN. G. 3

APPLICATION TO BE EXAMINED FOR A CERTIFICATE OF COMPETENCY AS
A FIRST CLASS OR A SECOND CLASS ENGINEER

Note.—Application should be made at an Examination Office as many days as possible before the applicant desires to sit. It should be handed in at least ten days before the examination. If it is not convenient for the applicant to attend, the Form together with the necessary enclosures and the appropriate fee should be sent by post. In this event the applicant will complete the Declaration (G) in the presence of the Examiner, prior to the examination.

(A) PARTICULARS OF APPLICANT

Surname (BLOCK LETTERS)		Other names in full (BLOCK LETTERS)		Present Address and Post Office Box Number	
				Discharge Book Number	
DATE OF BIRTH (BIRTH CERTIFICATE TO BE PRODUCED)			WHERE BORN		Nationality
Day	Month	Year	Town and District		

(B) PREVIOUS CERTIFICATES (ISSUED IN GHANA OR ELSEWHERE: IF NONE, STATE SO)

Number	Steam, Motor, Combined Steam and Motor Endorsement	Class	PLACE AND DATE OF		IF AT ANY TIME SUSPENDED OR CANCELLED, STATE		
			Examination	Issue	Court or Authority	Date	Cause

(G) DECLARATION BY CANDIDATE

To be signed in the presence of the Examiner.

Take Notice.—Any person who makes, or procures to be made, or assists in making, any false representation for the purpose of obtaining for himself or any other person a Certificate of Competency, is guilty of a misdemeanour, and renders himself liable to heavy penalties.

I HEREBY DECLARE that the particulars contained in sections (A), (B), (C), (D) and (E) of this Form are correct and true to the best of my knowledge and belief; and that the Papers enumerated in section (E) and sent with this Form are true and genuine documents, given and signed by the persons whose names appear on them. I further declare that (E) contains a true and correct account of the whole of my service without exception. And I make this Declaration conscientiously believing the same to be true.

Dated this _____ day of _____ 19_____

Signature of Candidate

Present Address

Signature of Witness, if an Examiner

(H) CERTIFICATE OF EXAMINER

PART A				PART B		Date of Examination	Place of Examination
State if exempt, previously exempt, previously passed, passed or failed.				Exempt, previously passed, passed, failed or not assessed.			
Sect. I		Sect. III		Sect. I			
Sect. II				Sect. II		Time penalty (if any)	Particulars of Certificate to be issued
				Sect. III			

(J) PERSONAL DESCRIPTION OF CANDIDATE

Height		Colour of		Complexion	Personal Marks or Peculiarities (if any)
Feet	Inches	Eyes	Hair		

I HEREBY CERTIFY that the particulars in (H) and (J) are correct and that Workshop and Sea Service have been verified by reference to Discharges and Testimonials (a) on this occasion (b) at a previous attempt less than 3 months ago.*

Date _____

Examiner

*Strike out portion not applicable

To THE SHIPPING COMMISSIONER,
MINISTRY OF TRANSPORT AND COMMUNICATIONS,
POST OFFICE BOX M.38,
ACCRA.

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THIRD SCHEDULE

SYLLABUS FOR THE SECOND CLASS ENGINEERS EXAMINATION (FISHING)

PART "A"

PAPER 1—MATHEMATICS

(a) *Arithmetic*

Calculations with integral numbers. Decimal fraction. Ordinary fraction, proper fraction, mixed numbers, improper fraction. Positive and negative numbers. Powers and roots, extraction of roots of 2 order. Simple equations of 1 order.

(b) *Plane geometry*

Point, line, area. Arc designations, circle. Bisection of lines and angles. Construction of perpendicular and parallel lines, angles of given magnitude. Pythagorean theorem. The circle. Properties of chords and tangents. Calculation of area of surface and perimeter of the square, rectangle, parallelogram, triangles, trapezoid, circlesector and circlesegment.

(c) *Mensuration*

Volumes and surfaces of prism, pyramids, spheres, cylinders and cones. Theorem applied to areas and volumes.

(d) *Trigonometry*

Sine, Cosine and Tangents of angles between 0° and 90° . Solution of right angle triangles. Proof of sine and cosine rules. Solution of simple trigonometric equations.

(e) *Practical calculations*

The metric system of weights and measures and its relation to the British system. The conversion factor of inch to mm. Decimals, percentages, interests, multiplication and division. Use of mathematical tables and logarithmic tables.

PAPER 2—ENGINEERING SCIENCE

(a) *Physics and Mechanics*

Properties of solids. Atoms and molecules. Specific gravity. Triangles and parallelogram of forces, simple graphical applications. Theory of levers. Laws of motion velocity, linear and angular acceleration, diagrams. Work, friction, energy, and power. Power transmission: Calculations for toothed gear, belt drivers, and chain drivers.

(b) *Liquids*

Properties of liquids. Behaviour of liquid under pressure. The hydraulic press. Relationship between liquid pressure and depth. Specific gravity by hydrometer and u-tube. Total force due to liquid pressure on immersed plane surfaces, horizontal or vertical. Equilibrium in floating bodies. Archimedes principles.

(c) *Gases*

Properties of gases. Volume and pressure of gases. Transmission of pressure, barometric pressure, gauge pressure, absolute pressure and vacuum. Barometers, vacuum gauges and manometers. Lb. pr. sq. inch. kg. pr. cm.² The principle of liquid and air pumps.

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(d) Heat

Properties and effects of heat. Temperature and thermometric scale. Conversion from Centigrade to Fahrenheit and vice versa. Linear and volumetric expansion due to temperature changes. Coefficients and the relationship between them. Heat units: B, Th, U and grain-caloric. Specific heat. Mechanical equivalent of heat. Heat equivalent of horse-power. Heat transfer by conduction, convection and radiation. Melting. Evaporation of water. Freezing point, dew point and boiling point of water. Wet, dry-saturated and superheated steam.

(e) Combustion

Solid and liquid fuels. Higher and lower calorific values. Simple explanation of the chemical composition of fuels. Chemical equations for complete combustion. Theoretical minimum air required. Excess air. The most important properties of liquid fuels and their characteristics. (Spec. gravity, viscosity, flash point and calorific value.)

(f) Internal combustion engines

Principle of the internal combustion engine. Classification of types according to:--

- (a) Working manner: 2-stroke, 4-stroke.
- (b) Fuel used: petrol engines, diesel engines.
- (c) Combustion principle: explosion, constant pressure.
- (d) Piston pressure: single working, double working.
- (e) End pressure: low pressure, middle pressure, high pressure.

The principle of the 2- and 4-stroke engine. Timing events, combustion, scavenging, piston speed factor.

Combustion: chemical action, ignition, flash and combustion temperatures, time, over- and under-load, ratio of fuel to air, need for fuel dispersion.

Compression: air intake, oxygen, advantages, supercharging, combustion chamber height, measuring, effect of high compression on construction.

Scavenging: ports, valves and blowers. Advantages and disadvantages of 2- and 4-stroke. Calculation of horsepower, BHP, IHP, EHP, calculation of fuel consumption.

PAPER 3—ENGINEERING DRAWING

Care and use of drawing instruments. Introduction to projection. The three co-ordinate planes of projection, first and third angle projection. The production of the plans, elevations and sections of simple details from isometric sketches. Free hand sketching of simple machine parts. The measuring of simple engine parts and dimensioning of engineering drawings. Introduction to symbols and limits, their indication on engineering drawings.

Sectional views.

Representation of screw threads, screws, bolts and nuts.

Reading and understanding of technical drawings. Technical lettering.

PART "B"

PAPER 1—ELECTROTECHNOLOGY

Simple electron theory. An electric current considered as the flow of electrons. Electric quality. The coulomb and the ampere. Conductors and insulators, electric circuit. Potential difference (in volts) as the cause of current flow. Ohm's law; simple calculations. Units. Use of ammeter and voltmeter. Series and parallel circuits. Practical applications in heating and lighting.

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The primary and secondary cells as sources of electrical energy. Internal resistance. Cells in series and in parallel. Resistivity and conductivity. Resistance of conductors and voltage drop in cables.

Electrical safety precautions. Earthing arrangements. Risk of fire and shock. Artificial respiration. Overload and short circuits, effects and protection by fuses.

Elementary magnetism; generation of an electro-magnetic force, generators, motors and starters.

Construction and operation of d.c. generators and motors. Concept of single phase and three phase a.c. systems. Simple a.c. generators and motors, alternating nature of current, frequency, effective voltage.

Starting, operation, and running of three-phase short circuit and slipping motors. Simple calculations.

PAPER 2 --REFRIGERATION

Revision of thermometers and their use, centigrade and fahrenheit scales and conversion. Types of thermometers thermo couple.

Names of common refrigerants in use, their advantages and disadvantages.

Introduction to the refrigeration system, compressor, condenser, evaporator, oil separator, liquid receivers, refrigerant controls. The low and high pressure sides. Direct and indirect cooling. Precautions when handling refrigerants. Brines, composition and density relative to temperature. Additives.

Insulating materials, piping and fans. Lead detection, defrosting. Adjustment, checking, and testing of refrigeration plant in operation.

PAPER 3—ENGINEERING KNOWLEDGE

(a) GENERAL

Fire fighting

Combustible and flammable products. Flash point, spontaneous combustion, explosive mixtures of fuel. Factors necessary for combustion: fuel, oxygen and heat. Sources of ignition. Storage of combustible products onboard ships. Precautions against fire and explosions. Hazards in handling petroleum products. Principles of extinguishing fires, starving, smothering, cooling. Methods of extinguishing fires, foam extinguishers mechanically and chemically produced foam. Carbon dioxide (CO₂) fire extinguishers. Dry chemical (powder) extinguishers. Carbon tetrachloride (vapourizing liquid) extinguishers. Permanent fixed CO₂ extinguishing system. Fire—and explosion hazards in the engine room. Fire fighting onboard ships. Fires in electric equipment, precautions.

Engineering materials

The composition, physical properties and engineering uses of pig iron, cast iron, wrought iron, malleable iron, mild steel and medium carbon steel.

Composition and suitability as cutting tool materials of carbon and high speed steels, cemented carbide.

Simple consideration of the heat treatment of plain carbon steels. Effect of carbon. Hardening, tempering, normalizing, annealing, and case-hardening. Nitriding. Overheating. Process of hardening and tempering for carbon steel tools. Colour method of judging temperatures and its limitations. Corrosion. Avoidance of corrosion. Comparison. Comparison of methods of metal plating and protective coatings and their application.

The properties and uses of metal alloys. Copper, zinc, tin, lead nickel, aluminium, magnesium, bronze, copper gunmetal, brass, bearing metals, such as Babbit white metals; and copperlead alloys.

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Machine components

Use of screw thread identification gauges and standard charts. Recognition and uses of unified nuts, bolts and studs. Selection and use of appropriate locking devices, washers and split pins. Plain bearings, ball and roller bearings. Friction, lubrication and maintenance. Simple gear trains. Complings. Handling and storage of spare parts. Jointing and packing materials.

Description of important auxiliary machinery and appliances including propulsive engines for electric generators, pumps, fans separators, evaporators, auxiliary boilers, clutches, couplings, alignment, winches. Ship construction and bilge system. Brief description of the construction of trawlers and cargoliners. Propellers and propeller shaft, stern tube, steering gears, tanks bilgesystem, trimming of vessels, watertight compartments, superstructure.

(b) MOTOR

Engine construction: general description of engine frames, crankshafts, cylinders, pistons, connecting rods, main bearings, cross end and big end bearings, thrust bearings, leads and adjustments.

Flywheel action, rim markings, balancing. Engine function: Valve-mechanism, cam shaft, cam shapes, fixed and regulating cams, valve types, seatings, rocker arm adjustment roller clearance.

Intake system: air cleaners, piping, intake valves, intake silencers, scavenging, supercharging, air ratio, effect on the consumption and carbonization.

Exhaust system: 2- and 4-stroke exhaust system, exhaust manifold, piping, backpressure, exhaust temperatures, silencers, insulation, calculation of horsepower, BHP, IHP, EHP. Calculation of fuel consumption.

Fuel system: air injection valves, Bosch hydraulic injection nozzle, mechanical injection nozzle, atomization, pre-combustion chamber. Fuel injection pumps, unit injector overflow regulation, cam regulation. Fuel tanks, gravity tanks, filters, strainers, pressures, piping.

Starting and reversing: requirements for starting, hand and air starting, electrical starting, cam operated valves, air operated valves, cartridge starting, reversing settings, priming, safety valves, compressors, 2- and 3-stage piston speed/piston area ratio, heat formation, valves, piping, safety devices.

Lubrication: necessity of lubrication, oil dilution, pressure and temperature, hand lubrication, drip lubrication, pressure lubrication. Common systems for lubricating engine running parts, types of filters, oil coolers, direction of oil circulation, piping. Failure of oil pumps. Maintenance and control of lubricating system.

Cooling: necessity of cooling, heat transfer, exhaust water temperature, cooling control, air cooling, sea water cooling, pumps, piping strainers, direction of flow, salting desalinization, electrolytic action, galvanic elements. Common defects of cooling system.

Engine timing: diagrams, effect and incorrect timing of valves and pumps, importance of clearance. Checking.

Governor: centrifugal principle, camshaft connections, fuel control, overspeed trip mechanism. Common defects and breakdowns. Auxiliary machinery and appliances.

Engine maintenance

Alignment of engine, crankshaft, gears and bearings. Inspection of engine parts for tolerance, wear, cracks, corrosion, damage and vibration.

Repair, reconditioning and replacement of worn and damaged parts. Measuring and adjustment of combustion. Chamber height. Extraction and insertion of cylinder liners and piston. Clearance of water jackets. Remetalling of worn bearings. Turning, fitting and scraping of bearings.

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Clearing of blocked oil channel. Fitting and adjustment of gas and oil piston rings. Cleaning and control of gate-valves, non-return valves and needle valves.

Grinding-in of valves, fuel pumps and injectors. Calibration and phasing of fuel pumps and injectors. Clearing of airlocks in fuel, oil and water lines. Clearing and maintenance of coolers, heaters, filters and strainers.

Checking of valve and pump mechanism for clearance. Testing and adjustment of governors and overspeed trip mechanism. Checking of valve timing by flywheel marks. Inspection of turboblowers. Periodic and preventive maintenance. Pressure testing of coolers, valves and water jackets. Overhaul and operation of compressors and air tanks. Preparation for starting, warming up, running and stopping of engines.

Operation temperatures and pressures of oil and cooling water. Engine turning and power operation, watch keeping routine and daily maintenance. Keeping of engine log and records. Clearing of bilges. Operation of the lub oil separator. Trouble shooting.

ORAL

The oral examination will be largely based upon the Engineering knowledge subjects of the examination and will include questions on the management of engines and boilers, electrical machinery prevention of fire and methods of fighting fires at sea, the duties of the supervising engineer, the work to be done to engines, boilers and auxiliary machinery in port and the periodical examination of the working parts.

Candidates should also be well acquainted with machinery and boiler casualties which may occur at sea and be able to state how these may be prevented and remedied. A knowledge of the appropriate statutes is also required.

FOURTH SCHEDULE

SYLLABUS FOR THE FIRST CLASS ENGINEERS EXAMINATION
(FISHING)

This examination also covers the syllabus for the Second Class examination but candidates for First Class Certificates will be expected to display a fuller knowledge of the different items in the syllabus than candidates for a Second Class Certificate.

PART "A"

PAPER I—MATHEMATICS

Arithmetic

Conversion of physical quantities involving length, area, volume or force from one system of units to another. Ratio and proportion. Percentages.

Algebra

Indices, including fractional and negative types. Use of common logarithms for multiplication, division, powers and roots. Simplification of algebraic expressions. Addition, subtraction, multiplication and division of algebraic functions. Rearrangement of formulae. Factorisation. Algebraic fractions. Simple equations.

Graphical work

Simple graphs of statistics. The graph $y = ax + b$ either from calculated values or from experimental results. Calculation of constants from graphs. Graphical solution of simple simultaneous equations involving two unknowns.

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Trigonometry

Measurement of angles in degrees and radians. Complementary and supplementary angles. Sine, cosine and tangent of angles up to 360°. Solution of right-angled triangles. Proof of sine and cosine rules. Solution of triangles by these rules. Solution of simple trigonometric equations.

Geometry

Properties of triangles. Sum of the angles. Relation between exterior and interior angles. Isosceles and equilateral triangles. Similar and congruent triangles. The circle. Properties of chords and tangents. Angles in the same segment. Angles at centre and circumference.

Mensuration

Areas of triangle, polygon, parallelogram, trapezium, circle, sector and segment of a circle and ellipse. Areas of oblique sections of regular solids of uniform cross-section. Area and mean height by mid-ordinate rule and by Simpson's rules. Ratio of areas of similar figures. Volumes and surface areas of prisms, pyramids, frustums, spheres, cylinders and cones. Ratio of masses, weights and volumes of similar solids. Solids of revolution.

PAPER 2—ENGINEERING SCIENCE

(a) Physics and Mechanics

Revision of properties of solids, specific gravity. Triangle and polygon of forces. Laws of motion: velocity and uniform acceleration. Work, friction energy and power.

Energy. Conservation of energy. Potential energy. Kinetic energy of translation. Velocity ratio, mechanical advantage and efficiency of the following machines. Wheel and axle. Differential wheel and axle. Rope pulley block. Differential pulley block. Screw jack. Worm drives. Reduction gears. Direct stress and strain. Shear stress. Hook's law. Modulus and elasticity.

(b) Liquids and hydraulics

Revision of properties of liquids, physical properties of liquids. Pressure and force in hydraulic systems. Hydraulic jacks and brakes. Liquid flow. Pressure gauges and volume meters. Pipes, fittings and seals. Simple valves. Compound and pressure reducing valves. Directional valves. Introduction to pumps. Reciprocating, centrifugal, propeller and axial pumps. Hydraulic liquids.

(c) Gases and heat

Revision of temperature and thermometric scales. Heat units. B.Th.U. and gram-calorie. Specific heat. Mechanical equivalent of heat. Heat equivalent of horse-power. Properties of gases and steam.

Description of the principles of the modern steam power plant; types of boilers, superheaters and condensers. Reciprocating engines and steam turbine machinery including auxiliaries. Evaporators and fresh water generators.

(d) Combustion

Revision of solid and liquid fuels. Complete combustion. Theoretical air. Excess air. Properties of liquid fuels and their characteristics. Viscosity, spec. gravity, flash point and calorific value. Impurities. CO₂ content of exhaust gases. Storage and treatment of fuel on board.

(e) Internal combustion engines

Revision of the principle of the internal combustion engine. Working manner; 2-stroke and 4-stroke. Piston and end pressure. The principle of the 2-stroke and 4-stroke engine. Timing events. combustion, scavenging, piston speed factor.

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PART "B"

PAPER 1—ELECTROTECHNOLOGY

Revision of the theory of electric current, potential difference, resistance, Ohms law, series and parallel circuits, resistivity and conductivity. Units.

Magnetism, generation of an electromagnetic force, generators, motors and starters.

Direct current, series, shunt and compound motors. Types of conductors, insulators, cables. Wiring diagrams, protective devices, fuses and earthing.

Concept of single phase and three phase a.c. systems. The sinusoidal wave, frequency, maximum r.m.s. and average values. Vector representation of a.c. quantities. Phase difference. Transformers. Converters.

Principles and function of switchboard indicating instruments. Use of ammeter and voltmeter. Ohmmeter and insulation testing. Accumulators. Resistance pyrometers. Bimetallic indicators. Rudder control. Engine order system. Trouble shooting. Maintenance. Electrical safety precautions on board.

PAPER 2—REFRIGERATION

Short revision of thermometers and their use, thermometer scales and conversion. Refrigerants in use, their advantages and disadvantages.

Temperature pressure relationship. Introduction to temperature pressure charts.

The refrigeration system. Cycle of operation.

(a) *Compressors*

Simple treatment of the operation of reciprocating compressors. Parts of the compressor and materials used. Lubrication of compressors. Treatment of volumetric efficiency and how it varies with suction and discharge pressures. Compressor capacities.

Lubricating oils, specific gravity, flash and fire points, viscosity, cold pour point, flash point, Refrigerant-oil relationship. Drying oil.

(b) *Condensers and liquid receivers*

Principle of operation of condensers. Desuper-heating. Latent heat and sub-cooled zones. Air cooled condensers and air flow. Water cooled condensers. Liquid receivers. Sight glass and try cocks.

(c) *Evaporators*

Plained and finned batteries. Forced draft. Vertical and horizontal air flow. Fans. Capacity of evaporators. Installation of evaporators and fans.

(d) *Refrigerant flow controls*

The automatic expansion valve. The thermostatic expansion valve with internal equalizer. The capillary-restrictor valve. The low and high pressure controls. The differential. Temperature controls used with refrigerant controls.

(e) *Accessories*

Drifts, sight glass, filters and the non-return valve. Heat exchanger. Vapour separator. Oil separator.

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(f) The electric system

The electric motor. The solenoid. The thermostatic switch. Starters. Pressure controls. Overload protector.

(g) Defrosting

Electric, water and hot gas defrosting. Time switch. Reverse cycle.

(h) Insulation and load calculation

Insulation. Moisture. Insulating materials. Heat conductivity. Storage temperatures.

PAPER 3—ENGINEERING KNOWLEDGE (GENERAL)

(A) GENERAL

(a) Fire fighting

Combustible and flammable products. Flash point, spontaneous combustion, explosive mixtures of fuels. Factors necessary for combustion: fuel, oxygen and heat. Sources of ignition. Storage of combustible products onboard ships. Precautions against fire and explosions. Hazards in handling petroleum products. Principles of extinguishing fires, starving, smothering, cooling. Methods of extinguishing fires, foam extinguishers mechanically and chemically produced foam.

Carbon dioxide (CO₂) fire extinguishers. Dry chemical (powder) extinguishers. Carbon tetrachloride (vapourizing liquid) extinguishers. Permanent fixed CO₂ extinguishing system.

Fire and explosion hazards in the engine room. Firefighting onboard ships. Fires in electric equipment, precautions.

(b) Engineering materials

The composition, physical properties and engineering uses of pig iron, cast iron, wrought iron, malleable iron, mild steel and medium carbon steel.

Composition and suitability as cutting tool materials of carbon—and high speed steels, cemented carbide. Simple consideration of the heat treatment of plain carbon steels. Effect of carbon. Hardening, tempering, normalizing, annealing and case-hardening. Nitriding. Overheating. Process of hardening and tempering for carbon steel tools. Colour method of judging temperatures and its limitations. Corrosion. Avoidance of corrosion. Comparison of methods of metal plating and protective coatings and their application.

The properties and uses of metal and metal alloy. Copper, zinc, tin, lead, nickel, aluminium, magnesium, bronze, copper gunmetal, brass, bearing metals, such as Babbit white metals, and copperlead alloys.

(c) Machine components

Use of screw thread identification gauges and standard charts. Recognition and uses of unified nuts, bolts and studs. Selection and use of appropriate locking devices, washers and split pins. Plain bearings, ball and roller bearings. Friction, lubrication and maintenance. Simple gear trains. Couplings. Handling and storage of spare parts. Jointing and packing materials.

Description of important auxiliary machinery and appliances including propulsive engines for electric generators, pumps, fans, separators, evaporators, auxiliary boilers, clutches, couplings, alignment, winches. Ship construction and bilge system. Brief description of the construction of trawlers and cargoliners. Propellers and propeller shaft, sterntube, steering gears, tanks bilge system, trimming of vessels, watertight compartments, superstructure.

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(d) Steam boilers and steam production

The principle of the automatic steamboiler. The regulation of feed water, steam pressure and steam production. Fuel control. Safety valves, water gauges and pressure gauges. Boiler efficiency and losses. Salinometers. Testing of feed water.

(e) Automation

Principles of remote control of temperature, pressure, R.P.M. and level.

The basic principles of automation and remote control. Flow diagrams. Mode of operation of the pressure gauge level indicator, d-p-cell, regulators relay, alarms and valves. Pneumatic and hydraulic control valves. Principles of remote regulations systems on board.

(f) Electrical engineering

Soldering of joints and simple cable joining. Maintenance of accumulators. Practical use of ohmmeter, ammeter and the megger. Start and stop of d.c. and a.c.-motors. Periodic control of motors and starters. Checking of ball-bearings.

Operation of generator switchboards. Description and function of switchboard instruments. Running of generators in parallel. Troubleshooting. Safety precautions and hazards to personnel. The principles of the gyro compass.

(g) Ship construction

Structural strains in ships. Longitudinal bending. Hogging and sagging conditions. Effect of water pressure. Docking strains. Local strains and local loading.

Structural details. Rolled sections. Framing. Beams and web frames. Keel construction. Structural arrangements of double bottoms with floor plates, longitudinal girders and inner bottom plating. Shell plating and deck plating. Rivetting and welding. Bulkheads, longitudinal and transverse. Pillars, girders, hatchways and watertight doors. Manholes. Engine seatings. The after part of the ship with the stem post, tail shaft, propeller and rudder. The fore end of the ship with the stem bar, collision bulkhead, capstan hawse pipes and chain locker. Merchant ship and trawler types. Classification societies, tonnage and freeboard. Periodical surveys.

Moments, centre of gravity and centres of buoyancy. Metacentric stability, Trim. Resistance and propulsion of ships. Fixed propellers. Adjustable pitch propellers. Preservation of hull and tanks. Casualty and damage controls. Pumping arrangements.

PAPER 4—ENGINEERING KNOWLEDGE (MOTOR)

Engine construction: general description of engine frames, crankshafts, cylinders, pistons, connecting rods, main bearing, cross end and big end bearings, thrust bearings, loads and adjustments.

Flywheel action, rim marking, balancing. Engine function: valve-mechanism, cam shaft, cam shapes, fixed and regulating cams, valve types, seatings, rocker arm adjustment roller clearance.

Intake system: air cleaners, piping, intake valves, intake silencers, scavenging, supercharging, air ratio, effect on fuel consumption and carbonization.

Exhaust system: 2- and 4- stroke exhaust system, exhaust manifold, piping, backpressure, exhaust temperatures, silencers, insulation. Calculation of horsepower, BHP, IHP, EHP, Calculation of fuel consumption.

Fuel system: air injection valves, Bosch hydraulic injection nozzle, mechanical injection nozzle, atomization, pre-combustion chamber. Fuel injection pumps, unit injector overflow regulation, cam regulation. Fuel tanks, gravity tanks, filters, strainers, pressures, piping.

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Starting and reversing: requirements for starting, hand and air starting, electrical starting, cam operated valves, air operated valves, cartridge starting, reversing settings, priming safety valves, compressors. 2- and 3- stage piston speed/ piston area ratio, heat formation valves, piping, safety devices.

Lubrication: necessity of lubrication, oil dilution pressure and temperature, hand lubrication, drip lubrication, pressure lubrication. Common systems for lubricating engine running parts, types of filters, oil coolers, direction of oil circulation, piping. Failure of oil pumps. Maintenance and control of lubricating system.

Cooling: necessity of cooling, heat transfer, exhaust water temperature, cooling control air cooling, sea water cooling, pumps, piping strainers, direction of flow, salting desalinization, electrolytic action, galvanic elements. Common defects of cooling system.

Engine timing: diagrams, effect and incorrect timing of valves and pumps, importance of clearance. Checking.

Governor: centrifugal principle, camshaft connections, fuel control, overspeed trip mechanism. Common defects and breakdowns. Auxiliary machinery and appliances.

ENGINE MAINTENANCE

Alignment of engine, crankshaft, gears and bearings. Inspection of engine parts for tolerance, wear, cracks, corrosion, damage and vibration.

Repair, reconditioning and replacement of worn and damaged parts. Measuring and adjustment of combustion. Chamber height. Extraction and insertion of cylinder liners and piston. Clearance of water jackets.

Remetalling of worn bearings. Turning, fitting and scraping of bearings. Clearing of blocked oil channels. Fitting and adjustment of gas and oil piston rings.

Cleaning and control of gate-valves, non-return valves and needle valves.

Grinding-in of valves, fuel pumps and injectors. Calibration and phasing of fuel pumps and injectors. Clearing of airlocks in fuel, oil and water lines. Cleaning and maintenance of coolers, heaters, filters and strainers.

Checking of valve and pump mechanism for clearance. Testing and adjustment of governors and overspeed trip mechanism.

Checking of valve timing by flywheel marks. Inspection of turboblowers. Periodic and preventive maintenance. Pressure testing of coolers, valves and water jackets. Overhaul and operation of compressors and air tanks. Preparation for starting, warming up, running and stopping of engines.

Operation temperatures and pressures of oil and cooling water. Engine turning and power operation, watch keeping routine and daily maintenance. Keeping of engine log and records. Clearing of bilges. Operation of the lub oil separator. Trouble shooting. Uses of the indicator.

ORAL

The oral examination will be largely based upon the Engineering knowledge subjects of the examination and will include questions on the management of engines and boilers, electrical machinery, prevention of fire and methods of fighting fires at sea, the duties of the supervising engineer, the work to be done to engines, boilers and auxiliary machinery in port and the periodical examination of the working parts.

Candidates should also be well acquainted with machinery and boiler. Casualties which may occur at sea and be able to state how these may be prevented and remedied.

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A knowledge of the appropriate statutes is also required.

Candidates for First Class Certificates will be questioned in the administrative duties of a Chief Engineer: organisation of his staff for emergency duties and the use of safety equipment, organisation of repairs and surveys. Reports to owners.

FIFTH SCHEDULE

No.

EXAMINERS AUTHORITY FOR DELIVERY OF A CERTIFICATE OF COMPETENCY TO AN APPLICANT WHO HAS PASSED HIS EXAMINATION

EXN.G. 16

Name of Applicant

Grade for which passed

Height..... Colour of Eyes..... Colour of Hair.....

Complexion..... Personal marks or peculiarities (if any).....

.....

Signature of Applicant

Please deliver to the above-named person the Certificate of Competency to which he is entitled.

.....
Signature of Examiner

Port..... Date.....

To: THE SHIPPING COMMISSIONER,
MINISTRY OF TRANSPORT AND COMMUNICATIONS,
P.O. Box M.38,
ACCRA.

SIXTH SCHEDULE
EXAMINATION OF ENGINEERS (FISHING)
RESULTS OF EXAMINATION
EX N.G. 18

*Insert "Exempt", "Passed", "Failed", "Assessed" or "Not Applicable".

Name of Candidate _____

Date	Port	Class	Qualifying Sea Service at time of Examination			Part A only, Part B only, Part A and Part B	PART A			PART B			Interval to elapse before re-examination	Examiner's Initials
			Y	M	D		*Mathematics	*Engineering Science	*Drawing	*Electrotechnology	*Refrigeration	*Engineering knowledge and Orals		

N.B.—Any subjects not shown "exempted" or "Not applicable" must be attempted by the candidate. This form must be produced by the candidate with his papers at all subsequent examinations.

OFFICE STAMP

Signature of Candidate.....

Signature of Examiner.....

Qualifying sea service standing to applicant's credit for Part B of the examination (after any appropriation to compensate for a deficiency in qualifying workshop service).

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SEVENTH SCHEDULE

EXN.G. 23

APPLICATION FOR COPY OF LOST CERTIFICATE OF COMPETENCY

N.B.—This Form when completed should be forwarded to the Shipping Commissioner who will issue the certificate.

PART "A"

Name of Applicant	Address	Date of Birth	Place of Birth

Number of former Certificate	Grade of former Certificate

PART "B"

PARTICULARS OF LAST SERVICE

Name of last Ship	Port of Registry and Official Number	Rating on Board	DESCRIPTION OF LAST VOYAGE			
			From	To	Com-menced	Ended

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**SOME OTHER SHIPS IN WHICH THE APPLICANT HAS SERVED BEFORE AND
AFTER OBTAINING THE CERTIFICATE NOW LOST**

S. No.	Name of Ship	Port of Registry and Official Number	Rating on board	Date Service Commenced	Date Service Ended

PART "C"

DECLARATION TO BE MADE BY THE APPLICANT BEFORE AN EXAMINER

I, _____ of _____ do hereby declare—

- (1) That my Certificate was a certificate of* _____ and that it was numbered _____
- (2) That the said Certificate was lost at† _____
- (3) That the statements made herein and in Parts A and B are correct to the best of my knowledge and belief.

Applicant's Signature

Declared and subscribed before me at _____ this _____ day of _____ 19____

Examiner of Masters and Mates/Engineers

* Insert the word Competency or Service.
† Here state the place, date, occasion and cause of the loss of the Certificate.

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PART "D"

DIRECTION BY THE SHIPPING COMMISSIONER

I am satisfied/not satisfied with the applicant's declaration in Part "C." A duplicate copy of the Certificate may /may not be issued.

.....
Shipping Commissioner

PART "E"

NOTE OF ISSUE OF CERTIFICATE

A duplicate Certificate has been issued this . . . day of 19 ..

.....
Shipping Commissioner

Note.—This Form should be retained in the office of the Shipping Commissioner and the Examiner informed of the action taken.

EIGHTH SCHEDULE

FEES

TABLE OF FEES

The fees, which are subject to revision, are:

<i>Certificate of Competency</i>	<i>Fees</i>
	<i>¢</i>
Second Class Certificate (Fishing)—Part A	8
Second Class Certificate (Fishing)—Part B	8
Second Class Certificate (Fishing)—Full examination	12
First Class Certificate (Fishing)—Part A	12
First Class Certificate (Fishing)—Part B	12
First Class Certificate (Fishing)—Full examination	20

If a candidate fails to pass any part of the examination no fee will be refunded to him. He will also be required to pay the fees in accordance with the above table irrespective of whether he takes the examination in all the subjects under the respective Part or re-appears only in the subjects in which he has failed.

COLONEL P. K. AGYEKUM

Commissioner responsible for Shipping

Date of Gazette notification: 29th November, 1974.

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