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Shipping in Cyprus

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SHIPPING IN CYPRUS

The Existing Maritime Infrastructure and General Recommendations on Maritime Education and Certification for the 1990s.

by

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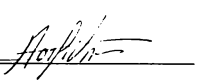
Cyprus

A paper submitted to the Faculty of the WORLD MARITIME UNIVERSITY in partial satisfaction of the requirements of the MARITIME EDUCATION (ENGINEERING) COURSE.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the UNIVERSITY.

Signature: 

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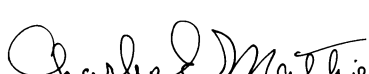

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ABSTRACT

This study describes and analyzes the existing maritime situation in Cyprus and provides general quidelines for the development of a complete maritime education and certification infrastructure in the country.

The paper is divided in two parts. The primary objective of Part One is to provide a clear briefing of the current status in Cyprus. In this part the political, economical and maritime situations in Cyprus are described as well as activities and achievements of Maritime Safety Administration, Ports Administration and Shipping Industry are analyzed. The general education system and the maritime education and certification systems are described and explained.

Part Two includes thoughts and recommendations for future policy on seafarers' education, examination for certification, certification for engineers and seafarers' affairs. This part is expected to provide valuable assistance to the Government of Cyprus in its efforts to create an adequate number of competent sea-going personnel to man the Cyprus ships in accordance with the requirements of national and international regulations.

Attached as an appendix is a proposed syllabus for certification/examination of engineer officers. It has been prepared in objective form.

PREFACE

The topic was selected for the following reasons:

i. This study could be a permanent source of information about Cyprus at the World Maritime University.

ii. The work might be useful to the Government of Cyprus in its plants to implement the IMO STCW/78 Convention and to develop maritime training in the country.

iii. The development of the text was expected to enrich the knowledge of the writer on maritime education matters. This experience could be very valuable to him and his country.

iv. The course professor recommended to the students of the Maritime Education (Engineering) course that they might elaborate on the present maritime status of their country projecting for 1993.

Part One of the study was principally based on information collected from various sources. These sources are listed in the bibliography.
Part Two however, was mainly based on the writer's previous experience. Very useful information was collected from lectures at the World Maritime University and from visits to maritime facilities and schools of various countries, during field trips with the University.
In particular, very valuable information sources were the IMO Mission Report on Maritime Training in Cyprus by Messers E. Moat and G.R. Hodge and the draft of the new Cyprus Maritime Legislation which was prepared by Mr. A. Moshonas, a Greek expert at the Department of Merchant Shipping.

The writer is very grateful to the professors of the World Maritime University and to all those who one way or another made information available to him.
He is particularly grateful to the professor of the Maritime Education (Engineering) course C. E. Mathieu who directed and supervised this project.
He also wishes to express his sincere appreciation to the Greek shipowner Mr. Minos Kyriakou who kindly sponsored one scholarship for a Cypriot citizen at the World Maritime University for the years 1983-1985.
The author is thankful to Mr. George Christodoulides, Director of the Higher Technical Institute in Cyprus and to Mr. George Iordanou, Head of the Mechanical Engineering Department of the same Institute, for having granted the necessary leave of absense.
Finally, the writer wishes to express very special thanks to his wife Angela for her assistance in preparing the manuscript and for her patience to type very efficiently this thesis.

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THE EXISTING MARITIME INFRASTRUCTURE

CHAPTER I

INTRODUCTION

Cyprus is a small island in the East Mediterranean sea. Since its independence in 1960 the country made great progress in every sector of its economy, despite its internal political problems.
The growth of the country as a major financial and shipping centre in the Middle East has been considerable, particularly after the 1974 Turkish invasion which led to a provisional de facto division of the island. The development was the result of introduction of a tax incentive legislation and the welcoming attitude to international business.
Numerous shipping companies, taking advantage of the legislation and the general economic development in Cyprus, established offices in the island and transferred their ships under the Cyprus flag. The increase of the number of ships under the Cyprus flag offers some advantages to the country but at the same time creates certain problems and responsibilities.

It is generally accepted, that shipping is the most international of all industries due to its nature. Operation of a ship by one country has undoubtly effects and impacts on the lives and the environment of many other states. Consequently, it has became world-widely agreed that vessels should comply with regulations applicable in all countries.
Hence, the International Maritime Organization introduced a number of International Conventions, the most important of which, as far as safety of life at sea and maritime environment protection are concerned, are the SOLAS/74, the MARPOL 73/78 and the STCW/78 Conventions.

The Cyprus Government has seriously considered the matter and has introduced measures in an effort to improve safety standards on board Cyprus ships. Within this policy the Government of Cyprus has ratified a number of these

Conventions and has sent eight students to the World Maritime University during the last two years. Furthermore, the maritime legislation of the country is currently under revision and modernization.

Within the objectives of the aforemention policy was the ratification of STCW/78 Convention earlier on this year. From the personal experience of the author, the present maritime infrastructure in line with a considerable number of the Convention's requirements. Maritime education however requires expansion.

This work was undertaken in an effort and out of a sincere wish to provide assistance to the Cyprus Government in implementing the STCW/78 Convention. The writer is inclined to believe, as a result of his present work, that a more close and detail examination of the issues related with the subject is required. It is hoped that the reader or the interest concerned will be able to familiarize himself with the various issues and note the key problems, which are pin pointed and for which either general or particular recommendations are offered. A number of these recommendations have already been put forward to the Cyprus Government and some of them have already been at least partially adopted. Furthermore, a number of them are "original" and may even be considered as "revolutionary" bearing in mind the Cyprus maritime environment.

The present work consists of twelve chapters arranged in two parts. Excluding Chapter I, the remaining seven chapters of Part One may be grouped into three units , as a result of their content.In spite of this fact,all of them may be read and understood independently as they are self contained. Chapter II provides the reader with general information about the island of Cyprus. The second unit which is formed by Chapters III to V inclusive, discusses the Cypriot maritime infrastructure except the issues related to seafarers' affairs; namely information concerning Maritime Safety Administration, Shipping Industry and Ports Organization, is provided. The last unit of the Part One, formed by chapters VI to VIII inclusive, deals with general education, maritime education and certification of seafarers respectively.
Chapters IX,X,XI and XII form the second part of this project. The first

two chapters present a recruitment and education of seafarers. Chapter IX includes a certification system and examinations for engineer officers. The last chapter is the conclusions and summary of recommendations.

The system which is proposed is the result of personal sea-going and teaching experience coupled with an extensive study of similar systems in other maritime nations.
Upon studying this part it will be found that more than one solution or recommendation is given to a particular problem. This was found necessary due to various reasons, among which are:
a. The absence of a similar case in the history of Cypriot seafarers' affairs, from which a pattern may be detected and an inference may be reached, or
b. solutions are numerous and consequently the advantages, where given, have to be discussed among those interested in the matter and the optimum solutions must be reached.

The Appendix to the present study consists of examination syllabus for certification of engineer officers. The original request, which came from the Director of the Higher Technical Institute, Nicosia, where the writer is a resident Instructor, was to prepare an outline of the examinable subjects in accordance with the STCW/78 Convention requirements and was made in early 1983. Following extensive studies it was concluded that this outline had to be presented in an objective form for reasons explained in the introduction to the Appendix.

CHAPTER II

BRIEF INFORMATION ABOUT CYPRUS

1. Location, Area and Population.

Geographically, Cyprus is situated in the East Mediterranean sea, 64 miles west of Syria, 44 miles south of Turkey, 240 miles north of Egypt and 240 miles east of Greek islands. The lattidute of Cyprus is between 34.33 and 35.44 north and its longitude is between 32.16 and 34.37 east.

The country is the third largest island in the Mediterranean sea with an area of 9,251 sq.km.(3,572 sq. miles). It has a maximum length of 241 km. from east to west and a maximum width of 95 km. from north to south.

The population of Cyprus is more than 650,000. Seventy-seven percent of the inhabitants are Greek Cypriots, 18% are Turkish Cypriots and five percent are other nationalities, mainly Armenians, Maronites, Latins and British.

2. Political System.

Cyprus, under its constitution, is an independent and sovereign Republic with a presidential system. The elected President of the Republic is head of the State. His term of office is set for a five-year period but he may be re-elected.
The President appoints the Council of Ministers, the executive organ of the Republic. In addition to the departments and services coming under the 12 ministries there are the following independent offices: The Attorney General's Office, the Audit Office, the Public Service Commission and the Educational Service Commission.

The Legislative power of the Republic is exercised by the House of Representatives, consisting of 50 members elected for a five-year period. Thirty-five members are Greek Cypriots and 15 members are Turkish Cypriots.

The Turkish Cypriot members do not attend the meetings of the House. The administration of justice is exercised by separate and independent judiciary.

Administratively, Cyprus is divided into six districts. The Republic's capital is Nicosia with a population of 120,000. Other main towns are Limassol, Famagusta, Larnaca, Paphos and Kyrenia.

Cyprus pursues and develops friendly relations with all countries and actively participates in efforts aiming at promoting international understanding and cooperation. Cyprus is a founder member of the Non-Alignment Nations Movement and member of the United Nations Organization and the United Nations agencies, including the International Maritime Organization. It is also member of the Commonwealth and the Council of Europe and it is linked with the European Economic Community.

3. History.

3.1 Old times.

The starting of the island's prehistory is estimated to have been in the beginning of the 6th millenium BC. During the 2nd millenium BC the Greeks established in Cyprus City-Kingdoms and introduced the Greek language and religion. The City-Kingdom system continued until the time of the Romans. Between the 8th and 3rd centuries BC the Assyrians, the Egyptians and the Persians became masters of the island.

In 332 BC Alexander the Great liberated the island from the Persians. On the partition of Alexander's empire Cyprus passed to the Kingdom of Ptolemies of Egypt. Later in 58 BC the island became part of the Roman Empire and in 330 AD passed to the Byzantine Empire. In 45 AD the apostles Paul and Barnabas converted the population to christianity. Saint Barnabas was the first bishop in the island.

Richard the Lionheart of England, in 1191 during the crusading period, detached the island from the Byzantines and he sold it to the Knights Templar

for one year and then to the Lusignans of France. The Lusignans ruled the island until 1489 when it passed to the Republic of Venice.

In 1570 the Turks invaded and conquered the island. The Turkish period lasted until 1878 when Cyprus became a British Colony. British rule ended in 1960 when after a four year liberation struggle by the Greek Cypriots, the island became an independent state and it was proclaimed a Republic. The United Kingdom kept two military bases in the south part of the island.

3.2 Modern times.

The constitution of the Cyprus Republic, which was imposed on the people of Cyprus, proved unworkable in many of its provisions and this made impossible its smooth implementation. In 1963 the President of the Republic proposed some amendments, to facilitate the functioning of the State. The Turkish Community, acting on instructions from Turkey, responded with rebellion. The Turkish Ministers withdrew from the Cabinet and the Turkish public servants ceased attending their offices.

In July-August 1974, Turkey invaded the defenceless Cyprus, with a full fledged army. The invasion, which was carried out in two stages, resulted in the occupation of about 37% of the island's territory by the Turkish forces. One third of the total Greek Cypriot population were forced to leave their homes in the occupied area and were turned into refugees. About 4000 people were killed during the invasion and 2000 Greek Cypriots are missing persons. Seventy percent of the capital resources were lost and one quarter of the labour force became jobless.

Today, almost 11 years later, Turkey is continuing to occupy 37% of the island, maintaining in the area 35000 troops, despite the repeated U.N. resolutions calling for respect of the independence, sovereignty and territorial integrity of the Republic of Cyprus and for the withdrawal of all foreign troops from the island. The violation of human rights by Turkey in Cyprus continues. Turkey steadily changes the demographic and historic character of the island by accommodating colonizers from the Turkish mainland to the occupied area, by converting churches to mosques and by destroying the antiquities.

On the 15th of November 1983 the Turkish Cypriots leaders, encouraged by Turkey, proclaimed an "independent state" in the occupied Northern part of Cyprus. All countries, except Turkey, condemed this partitioning movement. The only country which recognised the so-called "Turkish Republic of the Northern Cyprus", was Turkey.

3.3 Maritime History.

As Cyprus is located in the junction of three continents, in ancient times it was almost the centre of the shipping world. For many centuries, its geographical position, dense forests and rich copper mines, made the island a famous international industrial and trade centre.

During the Bronze Era (3rd millenium BC), parts on the north coast of the island flourished due to the export of copper. In the Iron Age (2nd millenium BC), the copper trade developed on the east coast and it was moved mainly through the port of Engomi. During the same period Greeks and Phonecians established new ports and they extended the trade and developed shipbuilding and other shipping activities in the island. Well known types of ancient ships were designed and built in Cyprus. The Cypriot Kercouros is mentioned as a famous shipbuilder. Cyprus was the strongest sea power for 33 years between 880 and 847 BC. The sea power of Cyprus continued during all the centuries before Anno Domini. In 332, Alexander the Great managed to capture the capital of the Phonecians, Tyros, with the naval assistance of Cypriots. During the Ptolemies dominion however, the maritime power of Cyprus declined, despite the continuation of the island as an important trade centre.

The most known ports which flourished during the period of the high development either in trade or in shipbuilding, were the ports of Salamis, in the East, Kition, Amathous, Curium, Old and New Paphos, in the South and Marion, Soli and Lapithos in the North.

4. Land and Forest.

The massive mountain range of Troodos which forms the backbone of the island in the Central-West, is covered with pine, dwarf, oak and cypress. The highest peak of Troodos culminates in mount Olympus 1951 metres above sea

level. In the North, following the coastal line, the limestone of Pentadactylos Range has a highest peak of 1024 metres.
Between the two mountain ranges lie the fertile plain of Mesaoria in the East and the partly irrigated Morphou plain in the West. Small valleys lie near the coasts, the most important of which are the Paphos, Limassol and Larnaca valleys in the South and the Chrysochou Valley in the North-West.
The rocky coastal line is interrupted by a great number of long sandy coves, mainly in the South and the East.
Cyprus has two lakes in the South, one of which is used for salt extraction. Both lakes are considered excellent biotops.

The total forest land is 1733 sq.km.which is about 19% of the total area of the island. The largest part of the forest area, which is mainly natural, is state land. The two mountain ranges are in the main forest areas.Smaller forests exist in other areas of the island.
The Forestry Department has in progress an ambitious program to reforest the Paphos forest which was burned by the Turkish air force in 1974. The Paphos forest is 15% of the total forest area. In addition to that, the plans of the Forestry Department include the creation of artificial forests in every area which is not cultivated or not used for livestock purposes.
The main species of Cyprus forest are pine, cypress, juniper, alder,arbutus and cedars.

5. Economy.

5.1 National income.

The post-independence period was characterized by rapid economic and social progress. The rate of growth over the period 1960-1980 was above 11% per annum in conditions of full employment. The development of the most productive sectors, ie. agriculture, industry and tourism was spectacular.

The advancement of all sectors of the Cyprus economy was halted by the 1974 Turkish invasion. To deal with the situation, the government of the Republic has introduced a series of Emergency Economic Action Plans of two year

duration each. The successful implementation of those Emergency Plans revived the economy. By 1980 the pre-invasion standards were reached in almost all economic sectors.
As a result, however, of the government's expansionary economic policy,the rise of prices internationally, full employment and the explosion of wage demands which followed the immediate post-invasion period of voluntary restraint, the inflation rate rose to 13.5% in 1980. A series of measures taken in 1980 resulted in a reduction of the inflation rate during the years which followed.

5.2 Agriculture.
Cyprus is traditionally an agricultural country. The main agricultural products are citrus, potatoes, table grapes, vine products, cereals,carrots, vegetables and olive oil. The arable land is about 47% of the whole island. Out of the total cultivated land about 14% is permanently irrigated, 24% is partly irrigated and the remaining 62% is non irrigated land. The use of fertilisers and mechanization are extensive.
The Government, aiming at higher income from agriculture,has introduced a series of measures such as irrigation projects, land consolidation, road construction, agricultural research, training and financial assistance schemes.

5.3 Livestock and fisheries.
The gross output from livestock constitutes 34% of the total agricultural output. The production of pork, poultry, meat and eggs satisfies the local demand.Large quantities of beef, veal and mutton, however, are imported.

The government has introduced a successful fisheries emergency plan to replace the losses in fishing industry due to the Turkish invasion which constitued 50% of the total fishing grounds. In 1980 the fish production reached the pre-invasion levels.

5.4 Mines.
Mining is one of the oldest industries in Cyprus starting with the Copper Age ie 5000 BC. Due to the depletion of known ore reserves and the effects of the 1974 invasion, the mining industry has declined in recent years.

In 1960, mineral exports represented 58% of the total exports, in 1970 they represented 35% and in 1980, when they reached 7.7 million Cyprus pounds, represented only 4.1% of the total domestic exports.
Local demand for quarrying materials has increased after 1974 and new crushing plants were erected to satisfy the demand.

5.6 Industry.

Serious industrial development started after 1960. The government, trying to encourage the private sector to invest in industry, has promoted the establishment of industrial estates in several areas of the island. Factory sites and buildings within these estates are leased by the government at reasonable rentals. In line with the policy of encouraging export industries and of exploiting the locational advantage of Cyprus, free zones have been established near the airport and main seaports of the island. Factory sites within free zones are leased on a long-term basis.

The manufacturing sector, which accounts for 18% of the gross national product and 22% of the total employment manufacturing activity is largely concentrated on export orientated industries such as those of cement, fertilizers, clothing, footwear and wines.
The construction industry grew very rapidly during the years 1974-78. In 1980 it accounted for 14.5% of the gross national product and 10% of employment. After 1980 there was a slack in the demand for residential construction. A number of Cypriot construction companies are profitably operating in the Middle East area.

5.7 Trade.

In recent years the island's negative gap in foreign trade has been constantly increasing. The difference in balance of payment is covered by invisible resourses, mainly accruing from the spending of tourists, the British bases in Cyprus, the Troops of the United Nations Force in the island and remittances from overseas and foreign capital inflow.

The main imported goods are capital goods, equipment, raw materials,mineral fuels and chemicals. The main exports are agricultural products ie. potatoes, carrots, fresh vegetables, table grapes, wines and spirits. The most

important industrial exports are ready-made clothing, cement, footwear, cigarettes, paper products, travel goods, plastic products, water pumps.

5.8 Tourism.

The highest single source of foreign currency inflow is from tourism. Healthy climate, natural beauty, antiquities and a great number of tourist resources make Cyprus an ideal place for holidays. The number of long-staying visitors and the income received from their visits is shown in Table I.

Year	Visitors (long-staying)	Income in Cyprus pounds (millions)
1981	429,000	102,4
1982	548,000	138,7
1983	620,000	170

Table I Number of visitors and associated income in 1981-83.

Countries of origin of the visitors to Cyprus, are the United Kingdom (about 25% of the total), other European countries, the Arabian countries, the United States and Australia.

A new trend is the development of Cyprus as a conference centre. In 1983, 278 international conferences with 12,500 participates took place in Cyprus. The Cyprus Tourism Organization, a statutory body subsidised by the government, has the responsibility for development and promotion of tourism.

5.9 Banks and Currency.

Cyprus has a well developed banking system. The Central Bank, which was established in 1963, exercises monetary and credit policy, administers international reserves, supervises banks and acts as banker and financial agent of the government. Under Central Bank supervision operate six commercial banks, three of which are local and three international. Three other international banks were recently established and operate as offshore banks. A cooperative bank and two other specialized financial institutions are engaged in financing activities.

The Cyprus pound (C) is divided into 100 cents. There are notes of half, one, five and ten pounds. The Cyprus pound is floating. In January 1985, one Cyprus pound was equivalent to about 1.5 USA dollars.

6. Communications.

6.1 Roads and road transport.

A road network of about 4200 km of paved and 5000 km of unpaved road exists in Cyprus. Most of the unpaved roads are under the juristiction of the district administrations and the Department of Forests. The total number of motor vehicles circulating in Cyprus at the end of 1983 was 196,000, thus it was one (1) vehicle per 3.3 inhabitants.

Cyprus acceded to the Customs Conventions on the International Transport of goods under cover of TIR carnets (TIR Conventions) of 1959 and 1975. Bilateral agreements for road transport were signed with most European countries.

6.2 Air communications.

After the closing down of Nicosia airport in summer 1974, a new airport in Larnaca was built in 1975. In 1983, 1.3 million passengers used Larnaca airport, compared to 380,000 in 1976. In 1984, the new International airport in Paphos started operation.

Cyprus is a member of the International Civil Aviation Organization and the European Civil Aviation Conference. Services to flights are provided by the Larnaca International airport and by the Nicosia Flight Information Region.

6.3 Telecommunications.

The Cyprus Telecommunications Authority is a public corporation responsible for the provision, maintenance and development of a comprehensive service both local and overseas.

The Authority provides:

a. 24-hour inland and overseas telephone, telegraph and telex service.
b. 24-hour telegraph and radio telephone service with ships at sea.
c. Telecommunication service with aircraft within the Cyprus flight information region.
d. Fascimile service.

These services are provided through excellent telecommunication infrastructure. Two satellite antenae operate satisfactorily, one towards the Atlantic Ocean region since 1980 and the other towards the Indian Ocean

region since 1982. Submarine cable systems connect Cyprus with Lebanon and Greece. Cyprus has direct deal telephone links with more than 70 countries and 150 on telex. In both cases other countries can be contacted through the operator. The island is said to be the fourth best country in the world (after the United States, the United Kingdom and Australia) in telecommunications.

6.4 Postal Services.

Postal services are provided by the Postal Services Department which comes under the Ministry of Communications and Works.

7. Development.

7.1 Electricity.

Electricity was introduced in Cyprus around 1910 by private companies. In 1952 the Electricity Authority of Cyprus was established as a public utility semi-governmental organization. The Authority has in operation three thermal power stations, providing electricity in every town and village in the island.

In accordance with the government's policy, the Electricity Authority continues to supply electricity to the occupied area, although it is prevented from collection of dues. The total amount of unpaid electricity consumed by Turks reached 23.266 million Cyprus pounds, out of which 12.374 million Cyprus pounds represent the cost of fuel up to the end of 1980.

7.2 Water Development.

The lack of water is the main problem of Cyprus after the political problem. The Government has invested a tremendous amount of money for water development. Between the years 1979-81, 33 million Cyprus pounds were spent on water development works for irrigation, domestic and industrial uses. Water storage capacity in recervoirs has increased, reaching 116 million cubic metres. Yet more than 300 million cubic metres of water run to sea every year. A number of projects are presently in process. In a few years time it is hoped that no drop of water will reach the sea.

7.3 Other development projects.

The Cyprus Government has established services and departments to deal with a number of other development projects in order to improve the country's economy. The most important of these services are the following:

a. The Geological Survey Department.
b. The Agricultural Research Institute.
c. The Metereological Service.
d. The Land Consolidation Authority.
e. The Department of Land and Surveys.

8. Employment, Industrial Relations and Safety.

Unemployment in Cyprus is low, around 3% of the total active population. Persons between 20 and 30 years of age and secondary school and college/ university graduates account for the great majority of unemployed persons. Industrial relations have been very satisfactory during the period of independence. Both labour unions and employer organizations showed responsibility in dispute cases. The government participation is through the industrial relation section of the Ministry of Labour and Social Insurance. The workers'right to safe and healthy working conditions, is safeguarded by appropriate legislation. Enforcement of the legislation is achieved through inspection by authorised inspectors.

9. Services.

9.1 Health.

The standard of health of the people is satisfactory. There is a doctor, three nurses and six beds per thousand population. The infant mortality is fairly low being 17.1 per thousand live births. The government offers medical services to about 80% of the population.

The Nicosia General Hospital is the main specialist centre of the island. Hospitals exist in all towns and medical centres in most of the bigger villages.

9.2 Social Insurance.

A new social insurance scheme was put into operation in 1980. The scheme covers compulsorily with minor exceptions all working persons in the island. The benefits of the scheme are compared positively with the benefits provided by similar schemes in developed countries.

9.3 Social Welfare Services.

The functions of the Department of Social Welfare Services are the following:

a. Delinquency and social defence.

b. Child and family welfare.

c. Public assistance and related services.

d. Community work and youth services.

These programmes provide counselling services and financial benefits with a view to enhancing the social well-being of individuals, families and communities.

9.4 Services to Displaced Persons.

A special service for the care and rehabilitation of displaced persons was established in 1974 in order to take care of the problems facing the 200,000 Greek Cypriots who were forcibly displaced from their homes by Turkish troops.

The service started with providing assistance in kind which was replaced by cash allowance after 1978. The housing problem was faced by erecting 23 tented camps in 1974, which were replaced by chipboard and timber huts in 1977-78. These constructions were finally replaced by low cost housing units. The service gives assistance to a thousand Greek Cypriots who are enclosed behind the Turkish lines and to the Turkish Cypriots who are living in the free areas.

9.5 Other Services.

a. Police and Fire Services.

Crime in Cyprus is maintained at low levels and the percentage of detections is satisfactory. The Cyprus Police which is the body responsible to fight common crime in Cyprus, has about 3500 members. The Fire Service has about 330 members.

b. Cyprus Theatrical Organization.

The Cyprus Theatrical Organization aims at promoting the theatrical art in Cyprus and in general the arts and the cultural progress of the people, as well as the development of the cultural relations of Cyprus with other countries.

c. Cyprus Athletics Organization.

The Cyprus Athletics Organization is the authority responsible for promotion of athletics in the island.

d. Cyprus International Fair.

The Cyprus international (state) fair which is member of the Union of International Fairs (UFI) provides exibitors a site of approximately 270,000 sq.m. of covered and uncovered space in a place four miles from the centre of Nicosia.

10. Mass Media and Information Services.

10.1 Press.

The press in Cyprus is developed and there are dailies, weeklies and periodicals of varying frequency expressing a broad spectrum of ideologies, covering a wide variety of subjects. At present there are 14 dailies of which 9 are Greek, 4 Turkish and 1 English.

10.2 Press and Information Office.

The department dealing with press matters and disseminating information to the mass media is the press and information office of the Ministry to the President. The office issues all government press, releases and statements on all matters and covers the activities of the President and Ministers.

10.3 Cyprus Broadcasting Corporation.

Radio programmes are transmitted on two channels. Channel one transmits daily programmes in Greek. Channel two transmits programmes in Turkish, English and Armenian. During summer, the channel transmits a programme of entertainment for visitors to the island in Arabic, English, French, German and Swedish. Television transmission is based on the SECAM system. Television programmes are on the air every evening transmitting programmes in Greek, English and Turkish. During morning hours, educational programmes are transmitted to schools.

CHAPTER III

THE MERCHANT SHIPPING DEPARTMENT

1. Establishment.

The Merchant Shipping Department was established in 1977. Previously, in 1963 a service to deal with merchant shipping affairs was established in the Department of Ports, which was operating under the Ministry of Communications and Works. The headquarters of the service were situated in Famagusta, which was the registration port of Cyprus ships.
Since 1974 the town of Famagusta has been occupied by Turkish troops and the port has by law been declared closed to international maritime trade.
In September 1974 the headquarters of the Department of Ports moved to Limassol. Limassol became the port of registration for Cyprus ships.
In 1977 the Cyprus Ports Authority started its operation and the Department of Ports was abolished. The Merchant Shipping Service, however, remained at the Ministry of Communications and Works and formed the nucleus of the Departments of Merchant Shipping.
An administrative officer acts as a liaison between the Department of Merchant Shipping and the Ministry of Communications and Works. This Officer assists the Director-General of the Ministry in matters related to merchant shipping. The Director-General who is the highest ranking civil servant in the Ministry, is the assistant of the Minister of Communications and Works.

2. Functions.

The Department of Merchant Shipping is responsible to the Ministry of Communications and Works for the following services:

a. Registration of ships and sales, mortgages and other related affairs.

b. Administration and enforcement of the law and regulations relevant to masters and seamen.

c. Control of shipping and enforcement of the relevant laws, regulations and international conventions ratified by the Government of Cyprus.

d. Investigation of accidents involving Cyprus ships or seamen serving

on those ships, or foreign ships sailing within the territorial waters of the Republic of Cyprus.

e. Investigation of reports on contraventions of international rules and regulations involving Cyprus ships.

f. Resolving labour disputes on board Cyprus ships.

g. Organization and training of courses for Cypriot seamen.

3. Organization and Personnel.

The present organizational structure of the Merchant Shipping Department is shown in figure 1 which is an extract from the annual report of the Department for the year 1981.

3.1 Director.

The Director has the overall responsibility for the efficient operation of the Department and he is dealing with the tasks arising from the international relations and legislation assisted by the surveyors. Additionally he is advisor to the government on maritime matters.

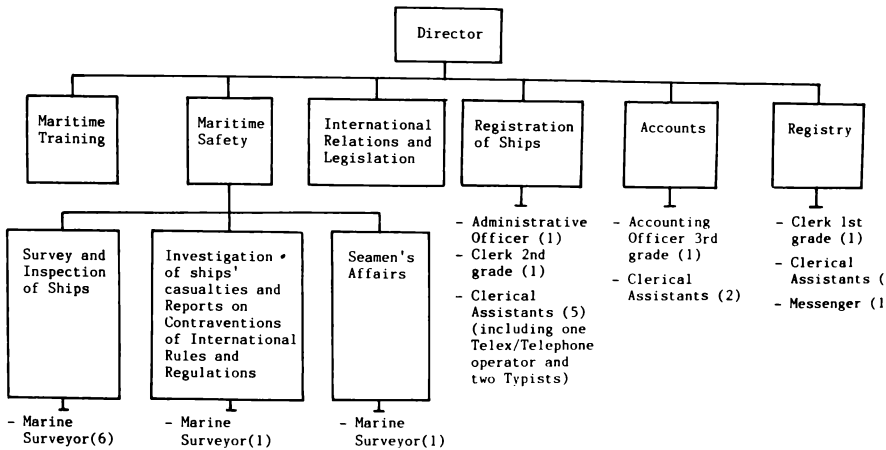
3.2 Surveyors.

Out of the eight surveyors recruited by the Department, seven are master mariners and one is a marine engineer/naval architect. Two of the master mariners have degree in general law. One of those two and two other of the surveyors are presently students at the World Maritime University in the Maritime Safety Administration (Nautical) 2-year course.
The surveyors very often attend courses and seminars organized by IMO or by other countries under the auspices of IMO.

3.3 Surveyors' Duties.

Two of the marine surveyors are serving in key ports abroad. One is posted to the Cyprus High Commission in London and he is also permanent representative of Cyprus to the International Maritime Organization. The other is posted to the Cyprus Consulate in Pireaus. These two surveyors, in addition to their duties as surveyors and inspectors of Cyprus ships, act as assistants to the registrar granting certificates of provisional

Figure 1 Organizational Structure of the Department of Merchant Shipping



registration and accepting documents concerning transactions in respect to Cyprus ships upon the registrar's instructions. In other countries, Cyprus Consuls or Honorary Consuls are often authorized to do the same.
The other three surveyors are posted at the department's headquarters in Limassol. One is responsible for seamen's affairs. He has been assigned also with the duties in respect to maritime training. Duties like tonnage measurement, casualties and reports investigation, representation of Cyprus at International Maritime Meetings, the duties of the Admiralty Marshall and other maritime matters are within the responsibilities of the other surveyors posted in department's headquarters.

3.4 Administration.
The administrative work is performed by the administration staff comprised of two administrative officers, two clerks, nine clerical assistance and a messenger.
Two out of the nine clerical assistants work in the accountant's office. The accounting officer is responsible for the financial affairs of the department.

4. Long Term Objectives.

Apart from the modernization of merchant shipping legislation and the fulfilment of obligations arising from this legislation, the department has set long term objectives aiming at further development of merchant shipping activities in Cyprus. The main objectives are the following:
a. The improvement of the quality of both the ships registered in Cyprus and the crews employed on them.
b. The improvement of safety standards and conditions of living and employment of seamen on board Cyprus ships in accordance with international conventions.
c. Further development of Cyprus in the area of merchant shipping and enhancement of the international reputation of the Cyprus flag as a maritime flag.
d. The establishment of maritime schools and other training facilities in Cyprus and the encouragement of more Cypriots for seafaring.

e. The continued improvement in sea transport services to and from Cyprus.
f. The cooperation in the establishment of the necessary infrastructure in the area of merchant shipping which will induce Cypriot businessmen to invest in shipping.

5. Policy Measures and Rules.

The Department of Merchant Shipping,on its way to achive its objectives, has introduced the following measures and schemes:

5.1 Modernization of Merchant Shipping Legislation.
The Cyprus merchant shipping legislation, which is based on the British Merchant Shipping Act 1984 is being gradually reviewed in order to meet today's international standards' requirements. Emphasis is given to provisions relating to safety standards and manning of Cyprus ships, to preventions of pollution of the sea, and seamen's welfare.

5.2 Ratification and Implementation of IMO Conventions.
A close study of the most important IMO Conventions for the purpose of ratification and implementation is a major priority for the Cyprus Government. The following Conventions have been ratified so far by the Cyprus Government:
a. IMO Convention and the 1975 amendments to same.
b. International Convention for the Safety of Life at Sea, 1960.
c. International Convention on Loadlines, 1966, as amended.
d. International Convention for the Prevention of Pollution of the Sea by oil, 1954 as amended in 1962, 1969 and 1971.
e. The Convention of International Regulations for Preventing Collision at Sea, 1972, as amended.
f. The International Convention on Standards of Training, Certification and Waterkeeping for Seafarers, 1978.

5.3 New Registration Rules.
With a view to eliminating sub-standard ships, a strict age limit of 17 years has been imposed for the registration of ships irrespective of

tonnage though it is still possible to register vessels up to 25 years of age provided certain stringent conditions are met.

5.4 Surveys, Inspection and Issue of Certificates.

Authorization for carrying out surveys and inspections of Cyprus ships on behalf of the government has been granted to the most of the international classification societies. These include Loadline, Equipment, Cargo Ship Safety Radiotelegraphy/telephony surveys as well as Measurement of Tonnage, Inspection of Carving and Marking Note and Surveys for the purpose of Registration.

The classification societies are duly authorised by the government to issue all the relevant certificates to Cyprus ships complying with the Conventions and Regulations applicable in the Republic except the Certificate of Registration which is issued only by the government.

5.5 Examinations and Issue of Certificate of Competency.

An arrangement for examining and granting certificates to radio officers has existed for some years now. Very soon a system for examination of engineer officers of all levels is to be established. It is being seriously considered to extend the system to include deck officers.

CHAPTER IV

SHIPPING INDUSTRY

1. Development.

The recent developing of Cyprus as a shipping centre in the Eastern Mediterranean area started after its independence. Both external and internal factors have shared in achieving this success. Externally, the increasing business importance of the Middle East, the re-opening of the Suez Canal and the events of recent years in Lebanon, added to the importance of Cyprus in the area. The rapid growth of the Cyprus economy, the introduction by the government in 1963 of modern shipping legislation and the incentives given to shipping companies, the developing programme of the Cyprus Port Authority, the excellent telecommunication and banking services, the availability of highly educated personnel and the enthusiastic participation of the private sector, were the internal factors which contributed to the growth of Cyprus shipping.

2. Registration of ships.

A ship, in order to be recognized as a Cyprus ship, has to be registered in the Cyprus Register for ships. Double registration of Cyprus ships is not allowed under the Cyprus legislation. The authority responsible for the registration of ships in Cyprus is the Department of Merchant Shipping.

According to the provisions of the relevant law for registration of a ship, the following conditions, inter alia, should be satisfied:

a. At least one half of the shares of the ship must be owned by Cypriot individuals or by companies incorporated in Cyprus or if specially authorised by a decision of the Council of Ministers, by foreign incorporated companies with controlling interest vested in Cypriots.

b. A ship, in order to be registrable, must be no more than 17 years old. Ships between 17-20 years of age are eligible for registration, provided that certain very strict conditions are satisfied.

c. The provisional registration, which is legally deemed to be full registration, is valid for six months but it can be extended for a further three months.

d. For approval of provisional registration, provided that all formalities are in order, it is required by the ship's classification society to confirm that the ship maintains her class and the society is willing to issue all Solas 1960 as amended and Load Line certificates without recommendations. Additionally, for tankers, confirmation is required that the ship complies with the MARPOL Convention as amended and with IMO Code as applicable to tankers. Certain other documents of formal character are also needed.

e. For permanent registration which should take place within the above mentioned period, the measurement of the ship and acquisition of a Cyprus Tonnage Certificate signed by a Surveyor is required. Solas and Load Line certificates are also needed.

The regulations have provision for detention if the conditions of registration are not satisfied.

3. Shipping Companies.

There is not any state-owned shipping company in Cyprus. Some Cypriots became ship-owners in recent years and their number is expected to increase. The best known of them are living abroad, managing their ships from Pireaus and London, where they have established ship-managing companies. Most of their ships, however, are flying the Cyprus flag.

In Cyprus, the main purely Cyprus interest ship-owning company is one operating 4 ferries linking Cyprus with Syria, Lebanon, Israel, Egypt and Greece. Another company operates 5 tankers and LPG ships between 800 tdw and 18500 tdw carrying petrol, lubricants, bitumen and liquified petroleum gas. Some other shipping companies owned by Cypriots are operating small tramps in the Mediterranean and Arabian Gulf area. The Association of Cypriot ship-owners based in Pireaus participates in discussions with Trade Unions for the formation of Collective Agreement.

The Cyprus flag has been chosen by a number of Europeans, Arabs and some ship-owners from Asiatic countries, for a number of reasons, the main one being tax advantages.

Besides the above, some foreign shipping firms mainly of German interest, have established their headquarters in Cyprus, managing their fleets from the island. One of them is operating about 65-owned ships. In 1972, the company was established in Limassol as a ship-operating company. Nowadays it has expanded, establishing satellite companies dealing with chartering, ship's finance, ship's sale and purchase, marine consultancy, marine travel services and marine training.

4. Ships on the Cyprus Register.

The Institute of Shipping Economics and Logistics - Bremen, in it's publication 'Shipping Statistics', gives to Cyprus the 12th position internationally in the list for the total world merchant fleet as at October 1st, 1984. According to the above Institute, in October 1984, 686 ships of 6.4 million grt or 11.3 million dwt were registered in Cyprus. At the same time the Cyprus flag shared 1.77% of the world dead weight tonnage.

The Table II which is based on information provided by the Cyprus Merchant Shipping Department, shows the conditions of Cyprus register in 30/9/1983 and 30/9/1984. The difference between the two dates indicates clearly the change of the Cyprus register during the period under examination. An increase in number of vessels by 12% resulted in an increase of net register tonnage by 30%, which means that few but large ships entered the Cyprus register during the period. This situation is in accordance with the government's policy towards fewer but larger ships. Large vessels normally are better maintained than smaller ones. In addition to the above, it is much easier for the government to exercise control on a small number of ships.

The Cyprus ships are mainly general cargo vessels, bulk carriers and tankers. These vessels are mainly tramp trading in every part of the world. The few specialized vessels which are listed in the Table II are trading mainly in Europe, the Mediterranean Sea and the Arabian Gulf.

DESCRIPTION OF VESSEL	30/9/1983		30/9/1984		CHANGE	
	No. of Vessels	G.R.T.	No. of Vessels	G.R.T.	No. of Vessels	G.R.T.
CARGO	505	1,922,158	507	2,143,640	2	221,482
CONTAINERS	4	4,339	8	18,268	4	13,929
RO RO CARGO/FERRIES	4	9,852	5	9,760	1	- 92
BULK CARRIERS	35	737,843	72	1,389,750	37	651,907
REEFER	1	499	-	-	- 1	- 499
TANKERS	50	1,948,226	73	3,004,797	23	1,056,571
CHEMICAL CARRIERS	3	4,795	3	4,795	-	-
PASSENGER	19	99,378	19	106,866	-	7,488
TOTAL MERCHANT VESSELS	621	4,727,090	697	6,677,876	66	1,950,786
FISHING VESSELS	26	5,137	23	4,974	-3	-163
TUG BOATS	10	1,438	12	2,341	2	903
MARINE SALVAGE VESSELS	1	232	1	232	-	-
LAUNCHES	2	108	3	175	1	67
BARGES	3	2,361	4	6,993	1	4,632
SURVEY	1	396	1	896	-	500
FLOATING CRANES	-	-	3	4,752	3	4,752
PASSENGER HYDROFOIL	1	142	3	294	2	152
YACHTS	562	12,383	619	11,907	57	-476

5. Safety.

The Department of Merchant Shipping, in an effort to improve the image of Cyprus flag by reducing the casualties of Cyprus ships, has established a system of frequent inspections by the department's surveyors or by surveyors of the appointed classification societies and it has set a 17-year age limit for new registration. It has also announced the intention to ratify more IMO Conventions as soon as possible.

6. Manning and Seamen.

The Merchant Shipping (Masters and Seamen) Law 1963, which is presently under review, regulates matters relating to manning, qualifications, employment and conditions of work of masters and crew, on board Cyprus ships. The new minimum manning requirements depends on ship's tonnage, type of ship, type of propulsion machinery and voyage distance.
There is an obligation under the regulations, that at least 15% of the crew of a Cyprus ship shall be Cypriots. In case of ships between 17 and 20 years old, for which an application is made to be registered in Cyprus, there is an obligation to employ a 51% Cypriot crew, if such a crew is available. Due to the scarcity, however, of Cypriot seamen such conditions are relaxed.
The officers and crew of Cyprus ships are required to be duly qualified for their post onboard ship. Their certificates of competency shall be granted by the Cyprus authorities or by one of the foreign countries , the certificates of which are equally recognized.

A collective agreement between Cyprus trade unions and shipowners has been in existence for the last few years. The agreement contains provisions for wages, extras, hours of work, holidays, leave and other relevant matters. Its signature is not obligatory for shipowners except in the case of a ship falling within the 17-20 age group. The agreement covers all seamen irrespective of nationality.

7. Shipping Industry Infrastructure.

Ship agents, clearing and forwarding agents, freight forwarders, ship chandlers, travel agents and other enterprises have been established and perform extremely well in Cyprus. Long standing shipping agents organized in the Cyprus Shipping Association have greatly participated in the development of Cyprus shipping. As a result of their efforts, a number of shipping lines, including conference lines, are represented locally and regular services are available to Europe and the Arab Countries.
Local and overseas shipping companies, based in Cyprus, are engaged in ship management, ship chartering, shipbroking, crewing and other similar activities.
Representatives of classification societies, other ship surveyors and surveyors appointed by other countries to survey on behalf of their safety administrations, marine consultants, representatives of P and I clubs, marine insurers and salvage firms, are also located in Cuprus.
Sales representatives of marine machinery, paints, chemicals and other consumable materials are established in Cyprus. Bunkers and lubricants are available either alongside or at anchor. Ship safety equipment is available and approved repairs of life rafts and safety boats are undertaken in the island.
The Supreme Court has exclusive jurisdiction in shipping matters (Admiralty jurisdiction) based in English law. A number of law firms now specialize in shipping law.

8. Ship-repair Facilities.

8.1 Famalift Shipyards.

The Famalift shipyards is the largest ship-repairing unit in Cyprus. The shipyards were established in 1976 at the western part of Limassol port. In 1978 the company started docking ships in a small floating drydock which was designed and built locally by Famalift. The drydock which has lifting capacity 1,360 dwt, length 63 metres and width 18.25 metres and can accommodate ships up to 75 metres, is the only drydock in the island. Between July 1978, when the first ship entered the drydock until the end

of 1984, 367 ships were docked. The shipyards can undertake repair work on docked ships irrespective of type and size of repairs. Any repair work on larger ships which could be carried out afloat, is also undertaken by Famalift shipyards.

8.2 Other Ship-repairing Units.

A number of other specialized ship-repairing units can undertake repair work in both Limassol and Larnaca ports. They normally carry out repair work on engines, shafts, piping, electrical, electronic and refrigeration systems. A number of firms are occasionally engaged in ship-scraping activities.

8.3 Boat Building.

Three boat building units construct pleasure crafts out of fiberglass, mainly under licence, in Nicosia and Limassol.

The traditional way of building and repairing small wooden fishing boats can still be found in some places in the island.

9. Fishing Fleet.

The Cyprus fishing fleet consists of 10 trawlers, of about 80 fishing crafts and of about 400 rowing fishing boats. All the above vessels are powered by diesel engines and are equipped with echo-sounders and means of communication.

Trawlers are between 25 and 30 metres long and their catching capacity is about 100 tons of fish. These vessels are equipped with freezers and they fish in the East Mediterranean Sea near Egyptian waters. The crew of trawlers consists of 6 to 8 persons.

The fishing crafts operate outside Cyprus territorial waters up to a distance of 100 miles from the coast. These vessels are of about 20 metres long and their crews consist of 6 to 8 persons.

Rowing boats are of about 10 metres long and fish in coastal waters. It should be noted that Cyprus waters are very deep and consequently are not rich in fish.

In Cyprus there are in operation 12 artificial fishing shelters and 7 anchorages suitable for summer sheltering.

About 1000 persons were employed onboard Cyprus fishing vessels in 1983. Almost half of those persons were vessel owners, permanently employed in fishing industry. Some 220 persons were part-time employed and about 350 persons were occasionally employed as crew members. The great majority of Cyprus fishing fleet crews are people from nearby Arab countries.

In 1983, 40,000 tons of fish were caught by the Cyprus fishing fleet. This capacity constitued 65% of the locally consumed fish during the year. During the same period a small quantity of sponges (15 tons) was collected in Cyprus waters.

10. Pleasure Boat Facilities.

10.1 Larnaca Marina.

Larnaca marina which is operating under the Cyprus Tourism Organization is situated nearby Larnaca shopping centre. Marina provides to yachtsmen water, electricity, telephone, bunkering, shopping, laundry and shower facilities. In addition to the mooring space for about 300 yachts, an extensive asphalted field for hard standing is available. Engine, hull and other repairs can be undertaken by a boatyard operating by private interest, under licence, in the marina.

The recently built administration building is equipped with a H.F. radio station which provides the ability for communication with any yacht or station anywhere in the world.

10.2 Other Shelters.

In other places of the Cyprus coast, artificial shelters have been erected, mainly in tourist resort areas, where small number of crafts can be sheltered. In the tourist area of Limassol, a private marina is presently under construction. The small port of Paphos is also used for anchorage of pleasure boats.

CHAPTER V

PORTS AND PORTS ADMINISTRATION

1. The Cyprus Ports Authority.

1.1 Establishment.

The Cyprus Ports Authority (CPA) is a national semi-governmental organization which operates on a commercial basis. The Authority was established by law in 1973 but its activities started in 1976. The overall objective of the CPA is to manage and exploit the ports in the Republic. Before 1976, port activities in Cyprus were under the direct control of the government, exercised through the Department of Ports which was functioning under the Ministry of Communications and Works.

By 1980, CPA gradually took over its responsibilities in the areas described by law. Meanwhile the various departments of the Authority were adequetely manned with well qualified personnel.

1.2 Activities.

According to the Cyprus Ports Organization Law of 1973, the Cyprus Ports Authority (CPA) is responsible to provide and maintain, at the ports within the area of its jurisdiction, adequate and efficient port services and facilities as necessary and to provide for the organization, administration and operation of the ports.

In order to be able to maintain the above services, the Organization is given power by law,

- to define, regulate, control and prohibit the use of any port area or equipment,
- to enter into all kind of contracts including selling or renting any of its property and
- to carry out business which is considered necessary or suitable within the area of its responsibility.

The main activities for which the CPA is responsible include, among others, the following:

- The maintenance of beacons, buoys and other navigational aids.
- The piloting, towing, anchoraging and berthing of ships.

- Transportation of passengers and goods.
- Bunkering, water and electricity supply to ships.
- Ship-building and ship-repairing activities.
- The maintenance and extension of berthing, storing and cargo handling facilities.
- Sorting, weighing, measuring and storing of goods.
- The supervision of activities within port areas.
- The organization of the security of ports.
- The provision of fire fighting facilities.
- Assistance to vessels in distress.
- The protection of port areas from any kind of pollution.
- The Authority is responsible for the efficiency of its personnel and facilities and is required to co-operate for training education and research activities.
- The CPA is required to co-operate with other Departments of the Government especially with the Department of Customs.
- The Authority is also required to advise the Minister of Communications and Works on any matter falling within its functions.

1.3 Control of the activities of the Authority.

The Council of Ministers having the high responsibility for the proper functioning of the CPA, is equipped with a number of control regulations which enable it to exercise supervision, on the activities of the Authority, preventing any malfunction in its operation.

These regulations include among others the following:

- The affairs of the Organization are subjected to investigation by the Minister of Communications and Works with the approval of the Council of Ministers, if the Minister believes that such investigation is necessary.
- The Council of Ministers has the power to transfer to the Minister of Communications and Works in whole or in part any of the functions of the Cyprus Ports Authority.
- The Council of Ministers has the power to declare closed for ships any port in the Republic of Cyprus.
- The CPA submits by the 31st of October each year to the Council of Ministers for approval its ordinary and development budgets for the ensuing year.
- The accounts of the Authority are audited annually by the Auditor-General of the Republic.

1.4 Structure and Organization.

The structure of the CPA is shown in the organization chart in Figure 2 which is an extract from the Authority's annual report for the year 1981. This chart shows the various departments and positions. In each position one or more officers may be employed. The Authority's three levels of management are: The Board of Management, the General Management and the Officers.

a. Board of Management.

The Board of Management is composed of a chairman, a vice chairman and four other members appointed by the Council of Ministers, for a period not exceeding three years and of the Director of the Department of Customs as as ex-officio member.

The Board is executive management body. It represents and manages the property and revenues of the Authority.

b. General Management.

The General Manager of the CPA conducts the daily affairs of the Authority and implements the decisions of the Board. The General Manager is appointed by the Council of Ministers in consultation with the Board and he is dismissed only after approval by the Council of Ministers. The General Manager is not a member of the Board of Management but he has the right to be present at all its meetings except when matters affecting him personally are discussed. He is furnished with copies of all notices, agenda and minutes of all meetings of the Authority.

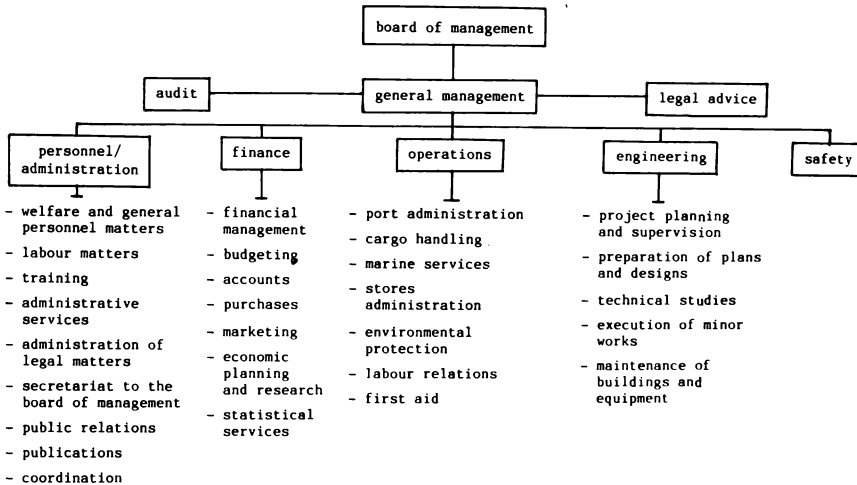
c. Officers.

The Authority has regulations relating to the appointment, promotion, dismissal, leave, medical and social benefits, remunaration, superannuation and other benefits for its officers. Disciplinary measures are also specified by regulations. These have been approved by the Council of Ministers. The appointment of qualified personnel is conducted through a special commission.

1.5 Training.

The Cyprus Ports Authority organizes seminars and workshops in cooperation with the Government and/or international organizations for its personnel and staff members of other Services. Specialized training

Figure 2 Organizational Structure of the Cyprus Ports Authority



organized by other Departments of the Government are attended by staff members of the Authority.
Senior staff members attend very often international seminars and training programmes organized by international organizations or foreign port authorities on matters related to port activities.

1.6 Safety and Health.
The number of accidents is constantly decreasing in the port areas. Stricter safety measures and the regular presence of the Authority's safety inspectors contribute to the reduction of accidents.
In an effort to improve health within port areas, the Authority has purchased new garbage collection and sweeping machinery and it has invited tenders for installation of incinerators at Larnaca and Limassol ports.The services for collection of the garbage from ships have been rendered by private firms.

1.7 International Status.
The Cyprus Ports Authority is a member of the International Association of Ports and Harbours (IAPH), a member of the International Cargo Handling Coordination Association (ICHCA)and a member of the International Association of Lighthouse Authorities (IALA) as responsible authority for the lighthouses in Cyprus.
The CPA has also close cooperation with IMO, ILO, UNCTAD and The World Bank organization where the Cyprus Government is a member and their activities are related to the CPA activities.

2. Ports.

2.1 History.
Cyprus being an island, has to rely upon sea transport for both its external trade and communications. The construction of appropriate port facilities was a factor of major importance for the country during its long history. Since the beginning of the century until 1974, the occupied port of Famagusta was the main port and the only one where ocean-going vessels could secure alongside. This port in 1906 had stone quays and in 1926 cargo

storage facilities. Early in 1950's some improvements were made in Limassol port facilities to avoid congestion problems and relieve the burden on internal communications.

Famagusta, however, remained the leading shipping centre, handling 83 percent of the Cyprus cargo by the time it came under Turkish occupation in 1974. With the closing of Famagusta port, Cyprus has been deprived of a very important infrastructure and it was fortunate coinsidence that the new ports of Limassol and Larnaca came into operation, shortly after the invasion.

2.2 Main Ports.

Two main commercial ports are in operation at present in Cyprus; the port of Limassol and the port of Larnaca. Both ports are in the South and are situated only 80 kilometres apart. These ports are not competing but supplement each other for traffic and their operations are coordinated, to obviate duplication.

Both ports are new - the port of Limassol came into operation in 1973 and that of Larnaca in 1978 - modern, purpose designed,neat,clean and tidy. Ro-Ro and containers handling facilities are offered at these ports. The port of Limassol also handles bulk cargo, both liquid (oils, wine) and dry (grain). The port has a big grain silo for bulk cargo handling. Passenger terminals exist in both ports.

Bunkers, fresh water, telephone and electricity, tax-free and stores supply are available in the ports area.Ship-repair work can be carried out either alongside or in anchorage. The Cyprus Fire Service provides fire extinguishing assistance when such assistance is required.

2.3 Special Terminals.

While Limassol and Larnaca ports are serving trade in general, a number of special terminals facilitate the trade of oil, minerals and other special cargoes. These terminals are Larnaca, Dhekelia,Vassiliko, Moni and Limni.

a. Larnaca oil Terminal.

It is situated few hundred metres in the north-east of Larnaca port. The terminal is used to serve the nearby Cyprus refineries for imports of crude oil and exports of oil products. Liquified gas is also transfered through this terminal to the store installations of the gas distributing companies in the vicinity.

b. Dhekelia Terminal.

The terminal is used for unloading of fuel oil to the two power stations of the Electricity Authority in Cyprus which are located in the area.

c. Vasiliko Terminal.

The Vasiliko terminal, which is about half way between Larnaca and Limassol, was designed to facilitate the imports of phosphate rock and ammonia and the export requirements of the fertilizer plant in the vicinity as well as the export of part of the exportable quantity of the Vasiliko Cement products. This port was developed recently by private sector finance.

d. Moni Terminal.

The terminal is used to serve the thermal power station of the Electricity Authority and the factory of the Cyprus Cement Co., which are situated in the area. The location of the terminal is about 10 kilometres east of Limassol port.

e. Limni Terminal.

Limni terminal is situated in the north-west coast of the island and it was used until recently for mineral exports. The decline of mineral exports resulted in termination of the use of this terminal.

2.4 Occupied Ports.

After the Turkish invasion in Cyprus, in 1974, the occupied ports of Famagusta , Kyrenia and Karavostasi were closed and declared illegal entry and exit points for any vessel. Since then, there has been no change in this situation.

a. Famagusta Port.

As stated earlier Famagusta was the main port for general trade of the island. Fifty-two percent of the quay capacity, 53% of the storage capacity, 70% of the state owned cranes and 65% of the private sector port equipment, were lost in Famagusta during August 1974.

b. Kyrenia Port.

The Kyrenia port is situated in the north of the island. The port was mainly used for small passenger and pleasure boats.

c. Karavostasi Terminal.

This terminal is situated in the north nearby to rich iron-mines. Until 1974 it was the main terminal for mineral exports.

2.5 Development.

When Limassol and Larnaca ports were planned and constructed, the Famagusta port was in operation and the decision for their capacity was taken in view of the pre-invasion conditions. After the loss of Famagusta port, the cargo flow increased tremendously in the new ports, causing congestion problems. The situation became more burdening when the civil war in Lebanon during the post-1976 years caused the transferring of great portion of Lebanese trade to Cyprus ports.

Evaluating the new situation, the Cyprus Ports Authority, decided on the extension of both ports and the improvement of their equipment. The extension, the coast of which was estimated in 50 million USA dollars, was partly financed by The World Bank loan. The extension programme was completed in 1984. Presently the two ports have the following particulars:

a. Limassol Port

The original quay of 480 metres has been extended to 1280 metres. The total storage space was increased to 337,000 sq. m. The 226,000 sq. m. is open storage space for containers and the remaining 111,000 sq. m. is storage space for general cargo.

Cargo handling equipment consists of a 60 ton floating crane, two 40-ton grantry cranes, a 35-ton mobile crane, other smaller mobile cranes, container handling equipment, fork lifts, tractors, trailers and other auxiliary items.

The approach channel is dredged to 12 metres and the inner harbour to 11 metres. The entrance width is 150 metres. Three pilot boats and three tugs, two of which are of 1000 kw are available in Limassol port.

A new administration and a new passenger buildings have been built and laboratories/workshops are constructed.

b. Larnaca Port.

Under the developing programme, Larnaca port quay length has been extended from 324 metres to 866 metres. Paved open storage for general cargo and containers has increased from 50,000 sq. m. to 150,000 sq. m. and a new warehouse of 12,000 sq, m. has been added making a total of 17,670 sq. m. A large crane for cargo handling gear is available including a 35-ton luffing crane and specialised container handling equipment.

The approach channel is dredged to 9.45 metres and the inner harbour to 9.5 metres while the maximum width at entrance is 10.6 metres. Two pilot

boats and three tugs,two of which are 560 kw and one 380 kw, are available in Larnaca port.
The administration/passenger building was recently modified and extended. Laboratories/workshops are constructed in the port area.

2.6 Other development.
In 1982 Solar Photovoltaic Systems were installed at two lighthouses, utilizing solar energy. In combination with a tele-alarm system, which was also installed during the same period, the operation of lighthouses is directly monitored from CPA Headquarters in Nicosia.

3. Traffic.

3.1 Total Seaborne Trade.
The seaborne trade constitutes one of the main factors of development of the economy of Cyprus. During the post independent years, until 1974, the total cargo through the Cyprus ports was constantly increasing. A drastic reduction occured in the island's seaborne trade in 1974 and 1975 as a consequence of the Turkish invasion. In 1976, however, the figures almost reached the 1973 peak levels. Since then, the total seaborne trade which includes Cyprus cargo and transit cargo is considerably increasing. The 1981 and 1982 seaborne cargo figures are shown in Table III.

3.2 Cyprus Cargo.
The Cyprus cargo has fluctuated during recent years. In 1982, imports constitutes 60% of the Cyprus cargo. Imported goods were mainly crude oil and crude oil products, iron and steel, grain and industrial products. During the same year, the exported Cyprus cargo through the government controlled port installations reached 40% of the total Cyprus cargo. The increase was 7% as compared to 1981 figures. Exported goods were cement, potatoes, citrus and other industrial and agricultural products.

3.3 Transit Cargo.
The transit cargo was tremendously increased since 1975. It should be noted that until 1982, the Cyprus Ports Authority was refraining from encouraging

transit trade to a degree that might create congestion problems. The flow of transit cargo is expected to increase after the completion of the extensions at Limassol and Larnaca ports.
Presently, two major shipping lines use Cyprus ports for their transit cargo in the area. Other international traders are expected to take advantage of the benefits offered by Cyprus to use Cyprus ports for transit cargo.

3.4 Container Traffic.

The increase in containerized traffic through Cyprus ports was spectacular. In 1982, Larnaca and Limassol ports handled 154,000 container units, compared with 30,000 units in 1978. During the same period containerized tonnage reached 35% of the total cargo traffic. Containers in transit almost reached 93,000. Limassol port handled 56% of the container flow. The remaining 44% moved through Larnaca port.

3.5 Passenger Traffic.

Passenger traffic through Limassol and Larnaca ports increased from 173,000 in 1981 to 225,000 in 1982. About 76% of the total passenger traffic moved through Limassol port. Eighty-five percent of the excursionists who visited Cyprus by sea in 1982, moved through Limassol port.

3.6 Ship Traffic.

In 1982, more and larger ships visited the Cyprus ports as compared to 1981 figures. Of the total number of ships calling at Cyprus ports during the year, 63% berthed at Limassol port and 32% berthed at Larnaca port. The remaining 5% visited the specialized terminals.

Table III Cargo flow (thousand tonnes) and ship traffic through Cyprus ports.

Year	Total cargo	Cyprus cargo	Transit cargo	Container (units)	Ships (NRT)	Ships (number)
1981	3,919	3,241	678	871	6,271	4,269
1982	4,650	3,591	1,014	1,126	9,577	5,015
change	17.5%	9.2%	50%	30%	53%	17.5%

CHAPTER VI

EDUCATION

The Minister of Education has the responsibility for the general education in Cyprus. Specialized education however, which is normally provided in higher levels, is under the responsibility of the corresponding Ministers. Education in Cyprus falls into four distinct categories as follows:

- Primary Education
- Secondary Education
- Third Level Education
- Special Education Schemes.

Figure 3 shows diagrammatically primary, secondary and third level education in Cyprus.

1. Primary Education.

1.1 Pre-primary Education.

Pre-primary is the first step of education in Cyprus. This type of education, which became a necessity after the 1974 Turkish invasion, is not generalised. The public pre-primary education is provided for children between 4 and 5½ years of age free of cost, but is not compulsory. The number of pre-primary schools is constantly increasing.

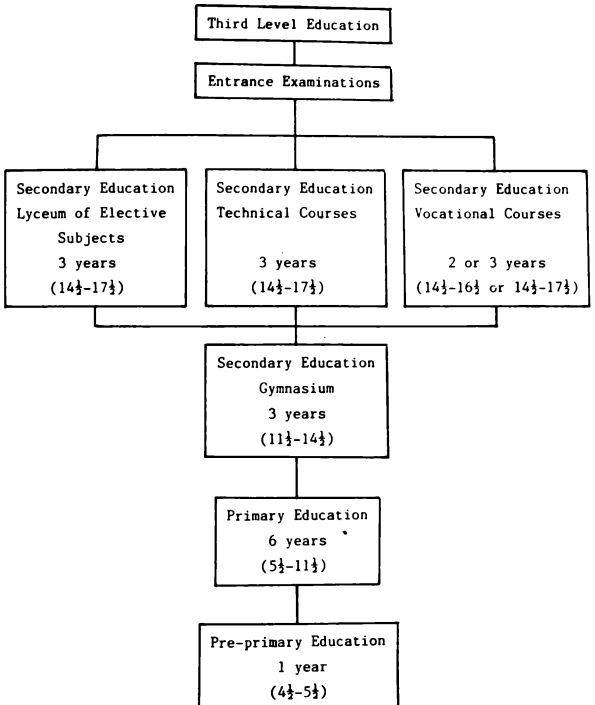
In 1982, the participation of the private sector in pre-primary education was about 42% by schools and about 49% by pupils.

1.2 Primary Education.

The primary education in Cyprus is free of cost and compulsory. This education starts at the age of five years and six months and continues up to the completion of either the prescribed six-year course or seven years of attendance. Children who have not completed the prescribed course during the compulsory seven years however, can continue primary education if they so wish.

Schools are functioning in every place where there is concentration of 7 or more children of school age. If the number of pupils is between 1 and 7,

Figure 3 Structure of Education in Cyprus



the pupils are carried daily at public expense and care, to the nearest appropriate school. The school buildings are suitable, amply furnished and provided with the necessary teaching aids.

Some large elementary schools, for administration purposes, are divided into Junior section comprising classes i to iii and Senior section comprising classes iv to vi. Emphasis in the work in the Junior section is on environment studies, oral expression and the aquisition of useful experiences as well as on the basic skills of reading, writing and mathematics.
The Senior section, however, offers opportunities to children to understand and respect their national and religious inheritance, to adapt themselves to their social environment, to develop a critical and creative mind and apply the democratic principles and procedures to their everyday life.

1.3 Private Primary Education.
Children of foreigners living in Cyprus and children of Cypriots, if they so wish, can follow primary education in private primary schools which exist in main towns. Teaching language in these schools is mainly the English language, but other languages are also used.

2. Secondary Education.

2.1 General Secondary Education.
General secondary education provides a six-year course to children between 11½ and 17½ years of age. The six-year course is divided into two cycles. The first cycle, the Gymnasium, comprises the first three years of secondary studies, classes i-iii, during which all children follow a uniform common course. The Gymnasium offers a general education course and serves as an observation period, postponing thus, by three years the decision for the selection of specialization giving time for more accurate appraisal of the pupils inclination and abilities. The Gymnasium cycle which is free of fees but not compulsory, is attended by about 97% of elementary school leavers. The second cycle which comprises the top three years of secondary studies is offered either in the Lyceum of elective subjects or in the technical

schools. Specially trained teachers advise and guide the pupils in their selection of the most appropriate type of education.

Although pupils choose any of the elective subjects, there are five main combinations of subjects which include related groups of elective subjects.

- Combination i: The emphasis is on classical studies.
- Combination ii: The emphasis is mainly on physics and mathematics.
- Combination iii: The emphasis is on economics.
- Combination iv: The emphasis is on subjects which offer skills for office professions.
- Combination v: The emphasis is on foreign languages and modern Greek.

It should be noted that all students have to attend compulsorily the common core subjects irrespective of combination. The common core subjects include languages, mathematics, history, religion, physics, chemistry, literature etc and is a continuation of the Gymnasium course. The purpose of the common core is to develop the overall abilities and skills of pupils.

Pupils of the Lyceum cycle have to pay very low fees. About 50% of the pupils are refunded either totally or partly their fees.

2.2 Technical Education.

Technical education is provided by public technical schools. At these schools two main categories of courses are offered: The Technician courses and the Craft courses.

The Technician courses (Technician section) are of three-year duration and the emphasis is laid on mathematics and science apart from specialization technology and skills aquired in the different specializations. Graduates of the Technician courses can be employed as technicians in industry or follow further studies in Colleges or Universities.

The branches offered in the Technician section are Mechanical, Electrical, Building and Graphic Arts.

The Craft courses (Vocational section) are of two-year duration and the emphasis is laid on acquiring skills. There is also an optional sixth year on a release basis, combining industrial training at a ratio of one to two between school and industry.

The branches offered in the Vocational section are Mechanical, Electrical, Building and Constructions, Hotel and Catering, Dress Making and Pottery.

Within each branch of both the Technician and the Vocational sections,

certain narrow specializations are offered and the pupils can choose one according to their abilities, interests and prospects of employment or further studies.
Technical education is universally free.

2.3 Secondary Private Education.
A number of private secondary schools operate in Cyprus offering education mainly in foreign languages. The syllabuses of these schools are approved by the government in order that their level is acceptable as equivalent to the Public Secondary Education.

3. Third Level Education.

The third level education or post-secondary education, could be classified as Higher and Highest Education. Education of higher level is defined in this context two-year or three-year education leading to a certificate or diploma of Technician or equivalent. Highest education is considered the university education.
Emphasis on higher level education, mainly on Technical higher education, was given after independence to meet specific needs of the country. This resulted in the gradual establishment of a number of specialized institutions. The following establishments of higher education operate in Cyprus.

3.1 The Teachers Training College or Paedagogical Academy.
The Academy offers three-year courses for kindergarden and elementary school teachers. The number of places in the Academy is limited because the graduates are primarily employed by the Government. The education in the Academy is free of fees. The students receive monthly allowance and are bound to serve the public education for at least five years after graduation.

3.2 The Cyprus Forestry College.
The Forestry College runs three courses: The Forest Trainee, the Junior and the Senior courses,of one year duration each. When the students complete one course they advance to the higher course. Since the establishment of the College in 1951, English remains its official language, overseas students being on the average 30.5% of the total number of students throughout the life of the College.

3.3 Higher Technical Institute.

The Higher Technical Institute (HTI) was established in 1968 as a joint project of United Nations Development Program and the Government of Cyprus. The Cyprus Ministry of Labour and Social Insurance and UNESCO, with assistance from the International Labour Organization, acted as executive agents of the project till 1973. From then onwards the operation of the HTI as originally set out by UNESCO is under the direct supervision of the Ministry of Labour and Social Insurance.

The Higher Technical Institute offers high level Technician Engineers training in the basic engineering specialization to meet the needs of industry of a developing country by providing suitable personnel to take up middle and other technical managers posts in industry and instructors' posts in Technical and Vocational schools. The courses are designed and organized at the level and standard of the United Kingdom Higher National Diploma and graduates satisfy the requirements of part I of the UK Engineering Council examinations for Chartered Engineer Status.

The regular programmes offered by HTI are three years study in Electrical, Civil, Mechanical and Marine Engineering. In addition to the full-time programme of study, the HTI offers a part-time Technician Engineers Diploma course of five-year duration for working technicians. Furthermore, the HTI continues to host a pilot project of UNESCO for Life Long Education and thus numerous short courses are offered for the professional and other needs of technicians and engineers working in industry.

A self-study centre enriched with a wide variety of subjects offering opportunities for self development to everybody,is operating at the HTI, during very convenient hours.

The Higher Technical Institute accepts students from overseas in all its courses within a general policy to develop the HTI into a regional training centre. Within this framework a joint project has been in operation since 1978 with the World Health Organization (WHO) under which a Regional Training Centre was established at the HTI for the purpose of offering training in the repair and maintenance of medical and hospital equipment and for providing advice on general maintenance policy. The students attending these courses are sponsored by WHO.

Furthermore the HTI provides consultancy services to the industry. Leather material testing centre is permanently hosted at the HTI. Research projects

mainly on energy, sponsored by local and international organizations, are continuously carried out by the HTI staff.
The Institute is governed by a board of governors with government, industry (employers and employees) and the professional associations concerned. The same composition is reflected in the committees which keep the Institute's syllabus and curriculum under constant review in order to ensure that the level and content satisfy the needs of industry.

3.4 Hotel and Catering Institute.
The Hotel and Catering Institute was established as a joint project of the Government of Cyprus, the United Nations Development Programme and the International Labour Office. The Institute offers ab initio training and upgrading courses in cookery, waiting, front office and housekeeping for basic, middle and higher level personnel in the hotel and catering industry. Short term, tailor-cut, supervisory courses are also offered in the hotel and catering professions mainly for Labour Office and Commonwealth Secretariat fellows from abroad. The Institute organizes special courses for ships cooks and stewards whenever there is demand.

3.5 The School of Nursing and Midwifery.
The school operates at the Nicosia General Hospital and at the Limassol Hospital. It offers three-year courses for secondary school graduates of both sexes. During the education the students are given monthly allowance.

3.6 Psychiatric School of Nursing.
This school operates also in Nicosia at the Psychiatric centre, preparing paramedical staff for the needs of the centre.

3.7 Private Higher Education.
Privately operated educational institutions offer higher educational courses in Business studies and Technology. A number of these institutions are affiliated with universities and polytechnics abroad and offer some of their courses locally.

3.8 University or Highest Education.

University Education is not offered in Cyprus. Cypriots wishing to follow university education have to enroll in universities abroad. The council of Ministers has decided in 1978 the establishment of a University in Cyprus but the implementation of the decision is delayed due to a number of reasons the most important of which is the existing political situation in the island. During the academic year 1981-82, almost 12,000 Cypriots were studying abroad. The same period, about 45% of Cypriot students abroad were studying in Greece, about 14% in the UK, 13% in the USA and about 7% in France. The remaining 21% were taking courses in other European countries and in Canada.

4. Special Education Schemes.

Under the title Special Education Schemes, comes a large number of educational establishments offering a wide spectrum of courses.The main establishment of those schemes are the following:

4.1 Establishment offering vocational training, retraining or upgrading courses at various levels.

The Cyprus Productivity Centre.

The Cyprus Productivity Centre was established in 1963 by the Cyprus Government with the assistance of UNDP and ILO.

The Centre offers inter alia the following:

- Courses and seminars at all levels to working executives and ab-initio programmes for secondary school graduates in industrial supervision.
- Accelerated up-grading and retraining programmes for technicians and workers for more optimum employment.
- Consultancy and research services to the public and private sectors.

4.2 Establishment offering specialized additional education to fullfil specific needs of groups of professionals or individuals.

a. The Paedagogical Institute.

It was established in 1973 in Nicosia with the purpose to offer specialized teaching courses to educators and to promote educational research and

technology. It also offers additional or refresher courses and seminars in teaching for those who are already in the profession or are to be involved in teaching.

b. The Mediterranean Institute of Management.

This Institute was established in 1976 as the regional-international component of the Cyprus Productivity Centre through which management training, consultancy and research services are offered to the countries of the Mediterranean Region and all developing Commonwealth countries.

The activities of the Institute include:

- The Post-Graduate Management Diploma Programme, organized annually between September and July.
- Organization of short up-grading programmes and seminars in all the fields of Management, designed to satisfy specific training needs of public and private organizations.
- Management Consultancy Services and Research Projects.

4.3 Schemes used to upgrade the level of Education of Adults.

Examples of such establishment are Institutes of Foreign Languages and the evening classes run by Technical Schools and financed by the government. Evening Gymnasia which are also establishments of this category, provide opportunities to working people to complete their secondary education. The private sector participates in the specialized schemes with many institutions of foreign languages and various courses offered mainly in office studies.

5. Education for Minorities.

5.1 Armenian Education.

The Armenian Community in Cyprus, has its own primary and secondary education operating under the supervision of the Ministry of Education.

5.2 Turkish Education.

The Turkish Community primary and secondary education was operating in parallel to the education of the other communities until 1974. The control of the Turkish schools was under the Turkish Communal Chamber. - For some

years after 1960, a Greek Communal Chamber had the responsibility of Greek schools including the primary schools of Maronite and Armenian Communities. The Ministry of Education was established later, in mid 60's -. The higher education was common for all Communities in institutions where the teaching is in the English language, like the Higher Technical Institute.
In cases where the teaching language is not English, like the Paedagogical Academy, a Turkish corresponding institution was operating. After 1974, the Turkish Community education is completely separated.

CHAPTER VII

MARITIME EDUCATION

1. Courses.

There is no Maritime Academy in Cyprus. A number of establishments however, offer education and training for Marine Engineer Officers, Radio Officers, and Ratings. In Nicosia,the Higher Technical Institute provides a three-year course for Marine Engineer Officers. Two private schools offer one-year courses for Radio Officers. In Limassol,the Hanseatic Marine Training School offers 12-weeks intensive courses for Deck Ratings, Engine Ratings and Stewards. The Hotel and Catering Institute in Nicosia, organizes special courses for Catering Ratings whenever there is demand.
The Greek Government offers thirty posts each year, in Greek Merchant Marine Academies for the training of Deck, Engineering and Radio Officers. This is the only way for Cypriots to become educated as Deck Officers.

2. Education for Marine Engineer Officers.

2.1 Establishment.

The Marine Engineer Officers course was introduced at the Higher Technical Institute (HTI) the academic year 1976-1977. The Institute was selected as the most appropriate institution in the island to provide the course with a minimum cost. At the HTI, the structure, the teaching staff and most of the required facilities, were readily available, because Mechanical Engineering and the other technical courses have been held since 1968.

2.2 Objectives.

The decision to establish the course was taken in an effort to diversify and increase the employment opportunities for Cypriots.
The objectives of the course are to provide the graduate with throretical and practical training, enabling him to be successfully employed as Cadet Engineer in the merchant navy with the possibility of subsequent promotion to Engineer Officer. Furthermore, the graduate is provided with the

possibility to seek employment ashore as instructor in maritime schools, as technical staff in maritime installations and companies or, if he so wishes, to continue for further studies abroad.

2.3 Facilities.

The Higher Technical Institute is well equipped for the training of the students of the Marine Engineer Officers course.

- The classrooms are equipped with the necessary visual and teaching aids.
- Marine division is organised at the Institute's library.
- General laboratories for science studies and extensive laboratories in production engineering, plant engineering, electrical and electronic engineering and computer science are available for general and specialized training.
- The Institute's workshop complex includes machine workshop, arc and gas welding workshops, sheet metal, pipe fitting and bench fitting workshops and electrical and marine workshops. In the machine workshop training, lathing, milling, facing, boring, cutting and other machines are used for practicing.
- The marine workshop is fitted with a steam power plant (boiler, steam turbine and ancillaries), two diesel engines, one of which is used for running and the other one for dismantling and assembling. Equipment for fuel pump and fuel valve testing and repairing are also available. A pumping system comprising different types of pumps and a steering gear system have been installed in a new part of the recently extended marine workshop.
- In addition to the above units, much other equipment and machinery is used for demonstration and practical training.

2.4 Entry Requirements.

The entry requirements for the course are the following:

a. Medical fitness, including eyesight and hearing.

b. Graduation of a secondary school or alternatively 12 years of education.

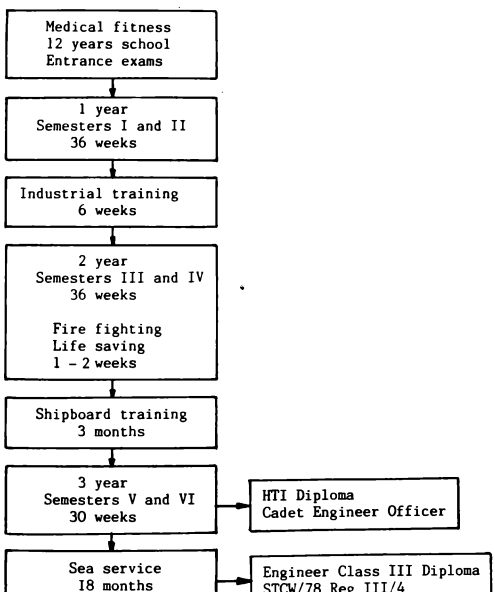
c. Passing the entrance examinations.

The entrance examinations take place each year in June and the candidates are examined in mathematics, physics and the English language. The ratio between candidates and places is about 4 to 1.

2.5 Studies.

The programme of the course which produces Marine Engineer Cadets is shown in Figure 4 . The graduate of the course is provided with theoretical and practical knowledge to perform the duties of the watchkeeping engineer officer according to the STCW/78 Convention Reg III/4. The graduates however, have to work 18 months at sea as Cadet Engineer Officers before being issued with the Engineer Class III Diploma. The sea service required is expected to be reduced to 12 months with the new regulations which will be introduced by the end of 1985.

Figure 4 Programme of the HTI Marine Engineer Officers Course.



The academic year commences in September and its duration is 36 weeks of studies. Each week comprises 32 hours of work, each hour being of 55 minutes duration. The semester system is used, the semesters in the first and second years being of 16 weeks duration plus 2 weeks exams at the end of each semester. The semesters of the final year are of 13 weeks duration each, plus 2 weeks exams for each semester. The course includes 6 weeks of industrial training in the summer vacation between the first and second years and 3 months sea training in the summer vacation between the second and third years of studies.

A special course in fire fighting and personal survival techniques is to be added as from the current academic year at the end of the fourth semester before the commencing of sea training. The course will be provided by the Hanseatic Marine Training School in Limassol, according to the STCW/78 requirements. The duration of the course will be either 1 or 2 weeks.

The curriculum and syllabus of the Marine Engineer Officers course is subjected to annual minor revision. A major revision is carried out every 5 years. All changes are submitted to the syllabus committee for approval. A revised syllabus was introduced in 1983 as a result of assesment done by IMO experts. The new syllabus, the framework of which is shown in Figures 5, 6 and 7 , will be forwarded to IMO for approval.

2.6 Study Fees.

The study fees are very low, about 100 Cyprus pounds (USA $ 150) per annum. Many of the students are exempted from paying fees taking advantage of the scholarship schemes. These schemes are maintained by contribution of the government and individuals.

2.7 Discipline.

The Institute has no lodging facilities for the students. The students live externally and are allowed to leave the school premises when they have no lessons. Up to 20% absences in each subject can be justified. The Institute provides the third year students of the Marine Officers course with summer uniforms for the graduation ceremony.

Figure 5 Marine Engineer Officers Course. 1st year.Topic·hrs/week.

List of Subjects	Time Allocation: hours/week			
1st Semester	Lectures	Tutorials	Practical	Total
1. Mechanical Engineering Science	2	-	-	2
2. Electrical Engineering Science	2	-	-	2
3. Strength of Materials and Structures	2	-	-	2
4. Technical Drawing	2	-	1	3
5. Physics	2	1	-	3
6. Engineering Mathematics	2	1	-	3
7. English for Technical Communication I	2	1	-	3
8. Engineering Science Lab.	-	-	8	8
9. General Workshop Practice	-	-	8	8
Total	14	3	11	28
			Cultural Electives :	2
			Individual Tutorials :	2
			TOTAL	32
2nd Semester	Lectures	Tutorials	Practical	Total
1. Mechanical Engineering Science	2	-	-	2
2. Electrical Engineering Science	2	-	-	2
3. Technical Drawing	2	-	2	4
4. Physics	2	-	2	4
5. Engineering Mathematics	2	1	-	3
6. Ship Science	2	-	-	2
7. English for Technical Communication I	2	1	-	3
8. Mechanical & Electrical Engineering Labs	-	-	2	2
9. General Workshop Practice	-	-	8	8
Total	14	2	12	28
			Cultural Electives :	2
			Individual Tutorials :	2
			TOTAL	32

Plus: 6 weeks Summer Industrial Training

Figure 6 Marine Engineer Officers Course. 2nd year. Topic.hrs/week.

List of Subjects	Time Allocation: hours/week			
3rd Semester	Lectures	Tutorials	Practical	Total
1. Applied Thermodynamics and Fluid Mechanics	3	1	-	4
2. Mechanics of Machines and Machine Elements	3	-	-	3
3. Production Engineering and Materials Technology	3	1	-	4
4. Electrical Engineering	2	-	-	2
5. Engineering Mathematics	2	-	-	2
6. Ship Structures	2	-	-	2
7. English for Technical Communication	2	-	-	2
8. Plant Engineering Lab	-	-	2	2
9. Production Engineering Lab	-	-	2	2
10. Workshop Practice	-	-	4	4
Total	17	2	8	27
			Cultural Electives :	2
			Individual Tutorials :	2
			Information Retrieval :	1
			TOTAL	32

4th Semester	Lectures	Tutorials	Practical	Total
1. Applied Thermodynamics and Fluid Mechanics	3	1	-	4
2. Introduction to Marine Power Plants	2	-	-	2
3. Production Engineering and Materials Technology	3	-	-	3
4. Electrical Engineering	2	-	-	2
5. Computer Programming	2	-	-	2
6. Engineering Mathematics	3	1	-	4
7. English for Technical Communication II	2	-	-	2
8. Plant Engineering Lab	-	-	2	2
9. Production Engineering Lab	-	-	2	2
10. Workshop Practice	-	-	4	4
Total	17	2	8	27
			Cultural Electives :	2
			Individual Tutorials :	2
			Information Retrieval :	1
			TOTAL	32

Plus 3 months
Summer Shipboard Training

Figure 7 Marine Engineer Officers Course. 3rd year. Topic·hrs/week.

List of Subjects	Time Allocation: hours/week			
5th Semester	Lectures	Tutorials	Practical	Total
1. Marine Internal Combustion Engines	3	1	-	4
2. Marine Steam Power Plants	3	1	-	4
3. Naval Architecture	2	1	-	3
4. Refrigaration and Air Conditioning	2	-	-	2
5. Marine Auxiliary Equipment	2	1	-	3
6. Automation, Control and Instrumentation	2	-	-	2
7. Safety and Firefighting	2	-	-	2
8. Maritime Affairs (Shipping Law)	2	-	-	2
9. Marine Engineering Lab	-	-	4	4
10. Workshop Practice	-	-	4	4
Total	18	4	8	30
			Individual Tutorials :	2
			TOTAL	32

6th Semester	Lectures	Tutorials	Practical	Total
1. Marine Internal Combustion Engines	3	1	-	4
2. Marine Steam Power Plants	3	1	-	4
3. Naval Architecture	2	1	-	3
4. Refrigeration and Air Conditioning	2	-	-	2
5. Marine Auxiliary Equipment	2	1	-	3
6. Automation, Control and Instrumentation	2	-	-	2
7. First Aid	2	-	-	2
8. Maritime Affairs (Marine Management)	2	-	-	2
9. Marine Engineering Lab	-	-	4	4
10. Workshop Practice	-	-	4	4
Total	18	4	8	30
			Individual Tutorials :	2
			TOTAL	32

2.8 Organization.

The Marine Engineer Officers course is under the responsibility of the Mechanical and Marine Engineering Department. The structure of the Department as part of the academic structure of the HTI is shown in Figure 8.

2.9 Employment.

Of the thirty students recruited annually to take the Marine Engineer Officers course, about 20 complete the course and are awarded the HTI Diploma as Cadet Officer of the merchant navy. Until 1984, 102 students have graduated and received the Cadet Engineer Diploma as shown in the Table IV .

Year	1979	1980	1981	1982	1983	1984	Total
Number of students	22	18	11	13	20	18	102

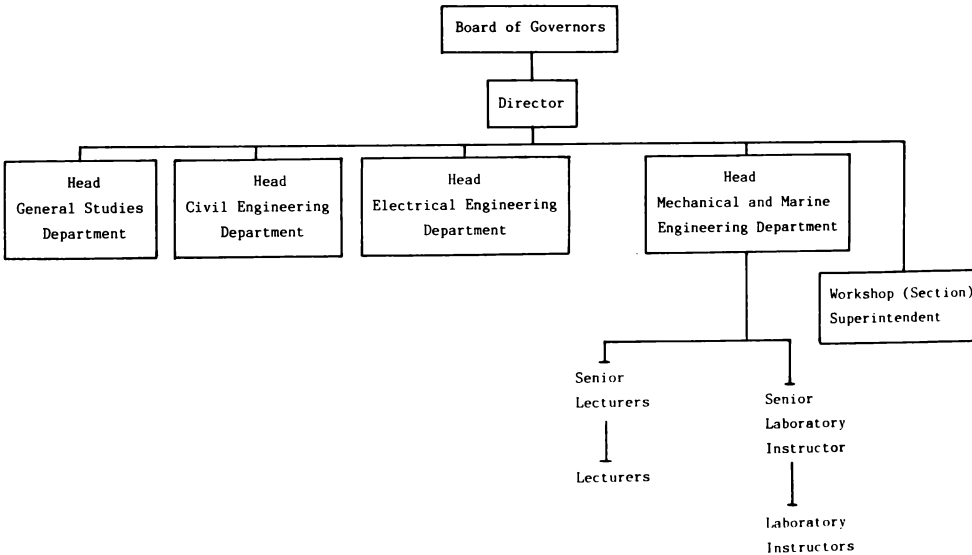
Table IV Graduates of the HTI Marine Engineer Officers course.

Out of these 102 graduates, only 7 have pursued a career at sea and have qualified as Marine Engineer Officers. Of the other 95 graduates, 38 are temporarily serving in the Cyprus National Guard and about 25 continue the studies abroad. Of the remaining 32 students, 3 were foreign students and 29 are employed in shore installations.

3. Radio Officers.

Two private Institutions, the Higher College of Technology in Nicosia and the Morse School in Limassol, offer one year course for Radio Officers. The Higher College of Technology runs Higher Diploma courses in Engineering, Business Studies and Computer Technology. The entry requirements for the Radio Officers course are the same as for the other courses. The College is well equipped in the general radio and communications field.
The Morse School offers a course of acceptable level.
Students, on the completion of the course, are examined by the Ministry of Communications and Works and those who succeed in the examinations are awarded the Wireless Operator Class II Certificate.

Figure 8 Academic Structure of the Higher Technical Institute



4. Hanseatic Marine Training School.

4.1 Establishment.

The Hanseatic Marine Training School (HMTS) was established in 1984, by the Hanseatic Shipping Company Limited, adjacent to the Limassol old port after agreement between the Government of Cyprus and Hanseatic. Hanseatic is a shipping company of German interests based in Cyprus since 1972. The company operates about 65 ships of all types and sizes from its Headquarters in Limassol. The agreement of the establishment of the School provides for Hanseatic to lease the area and the installations previously used by the Eastern Mediterranean Shipyards for a period of five years. The agreement will be reviewed in five years time and the Cyprus Government has stated its intention of taking over the School in ten years time.

4.2 Installations.

The facilities of the School comprises:

- Classrooms equipped with teaching and visual aids.
- Workshops equipped with metal work machinery including lathing, drilling, cutting, shaping and milling machines as well as gas arc welding units.
- Demonstration rooms for training and for repairing engines and machinery.
- Two sets of davits with lifeboats and other lifesaving appliances.
- Rigging workshop, hospital and other facilities are included in the installations of the School.

Most of the equipment have been donated both by local Cypriot firms and from abroad.

4.3 Courses.

The Hanseatic Marine Training School offers courses of three months duration for able-bodied seamen, motormen and stewards.

The able-bodied seaman course includes maintenance and general repair of deck equipment, rigging, cargo gear handling and bridge watch-keeping duties.

The motorman course includes basic engineering knowledge, maintenance and general repairs for engine equipment and engine room watch-keeping duties.

All three courses include personal survival techniques, fire fighting and first aid medical training according to regulations and recommendations of

the relevant IMO Conventions. Certificates of training are issued to those who successfully attend the courses. The types of certificates have been approved by the government and the issues are signed by the Director of the Merchant Shipping Department.
Special courses in tanker operation and safety, LPG carriers, and inert gas system courses have been planned and are within the abilities of the HMTS. Other courses may be added when the need arises.

4.4 Training.
The Principal of the School is a former merchant marine master. A chief officer and a second engineer have been appointed as deck and engine instructors respectively. All three staff members of the School are ex-Hanseatic marine officers. Visiting teachers lecture from time to time on specialized subjects.

The capacity of the School is sixty students for all courses at the same time. Half of the places are available for Cypriot nationals. The other thirty places are filled by Asian crew (mainly Burmese) who are selected and brought into Cyprus by Hanseatic.
Basic knowledge of English and a kind of examination is required for entrance into the School.
Tight disciplinary measures exist in the School. Classes are held during the morning and afternoon hours. The daily routine is kept as closely as possible, to what the students will experience on board ship.

The HMTS has been incorporated as a non profit making establishment. Trainees do not pay for their education. The Cyprus Government contributes 20 Cyprus pounds (USA $ 30) per month for each Cypriot student to the Hanseatic's lease payments of the side. The School provides the students room and board as well as pocket money.

The Examining Board consists of government officers, school officials and representatives of the classification societies.

The trainees, on the completion of their studies, are examined by the Board, which recommends the award of the certificate to the successful candidates.

The Hanseatic Shipping Company quarantees the employment of fifty percent of the graduates. The other fifty percent are free to choose either other shipping companies or employment ashore. Hanseatic intends to bring back its crew for refresher courses after two years of service on board ships, under the master's supervision.

CHAPTER VIII

REGISTRATION, EXAMINATION AND CERTIFICATION OF SEAFARERS

1. Registration.

The Ministry of Communications and Works has the responsibility for the registration of seafarers. The registration however, is not required by law. Therefore many Cypriot seamen are not registered and consequently the exact number of Cypriot seamen is not known. This gap in the Cyprus Maritime Legislation is expected to be filled very soon. After that, a complete registration system is planned to be introduced at the Ministry of Communications and Works.

The registration is closely related to the issue of seaman's books. The Ministry has established a procedure for issuing a seaman's book to every citizen after request, if certain requirements like age and medical fitness are satisfied. Greek seaman's books are also issued to Cypriots by the Greek Ministry of Merchantile Marine if the requirements of the Greek Ministry are fulfilled.

Many Cypriots use their passports to seek employment on board of Cyprus ships or on board of foreign ships, taking advantage of lack of legislation and control. These seamen are not registered and they are not protected by any pension or loss of ability scheme.

2. Trade Unions.

Many Cypriot seamen are organized in Trade Unions either in Cyprus or in Greece. Traditionally there were in Cyprus two trade unions, the Confederation of Cyprus Workers (SEK) affiliated to the International Transport Workers Federation and the Pancyprian Workers Federation (PEO) affiliated to the International Transport Trade Union. A few years ago, another seamen trade union, the Association of Cypriot Seamen, was established. None of the above trade unions has succeeded however to organize the majority of Cypriot seamen.

A number of Cypriots consider employment at sea a temporary situation for

them, therefore they are reluctant to be organized in trade unions, trying to save the contributions. All Cypriots, however, who are employed on ships flying the Greek flag are considered by Greek authorities members of the Panhellenic Seamen Federation and their contributions to the Federation are compulsorily advanced by the ship's Master.

3. Certificates of Competency.

The part of the Cyprus legislation dealing with certificates of competency was recently revised. According to the new Merchant Shipping (Master and Seamen) Law, the Cyprus Government will issue a Diploma for an officer and a Licence for a rating. All diplomas and licences are listed below.

a. Deck Department.
i. First Class Captain Diploma (A)
ii. Second Class Captain Diploma (B)
iii. Third Class Captain Diploma (C)
iv. Practical Captain Licence
v. Boatswain Licence
vi. Able body Seaman Licence

b. Engine Department.
i. First Class Engineer Diploma (A)
ii. Second Class Engineer Diploma (B)
iii. Third Class Engineer Diploma (C)
iv. Practical Engineer Licence
v. Fireman Licence
vi. Oiler Licence

c. General Service Department.
i. Wireless Operator Diploma
ii. Purser Diploma
iii. Chief Steward Licence
iv. Steward Licence
v. Chief Cook Licence
vi. Cook Licence

It is obvious that there are no provisions for Masters and Chief Engineers Diploma. The higher certificate in deck department is the First Class Captain Diploma and the highest Diploma in engine department is the First Class Engineer Diploma. A Master and a Chief Engineer are only positions on board ship and seafarers qualified to perform the duties of a Master and a Chief Engineer are seafarers with First Class Captain and First Class Engineer Diploma respectively.

The Practical Captain Licence and the Practical Engineer Licence are issued to an experienced deck or engine rating respectively, after examinations. These licences are equivalent to watchkeeping certificates - STCW/78 Reg II/4 and III/4.

The requirements according to which a diploma or a licence will be issued under the new legislation were not available by the end of March 1985. It is expected however, the Cyprus legislation requirements will exceed the requirements of the STCW/78 Convention. The Convention was ratified by the Cyprus Government in January 1985.

4. Certification Requirements.

There is at present no system to conduct examinations for issuing certificates of Competency. The only examinations conducted so far by the Ministry of Communications and Works are examinations for the Wireless Operators.

The Department of Merchant Shipping is currently revising the Merchant Shipping Laws relating to Masters and Seamen. Completely revised legislation is expected to be ready by the end of 1985.

The existing (old) regulations relating to certificates of competency are:

a. Regulations for Certification of Only Mate, 1965.

b. Regulations for Certification of Wireless Operators, 1976.

c. Regulations for Certification of Engineers,1977.

The regulations for Only Mate states requirements for oral examinations and defines the validity of the certificate.

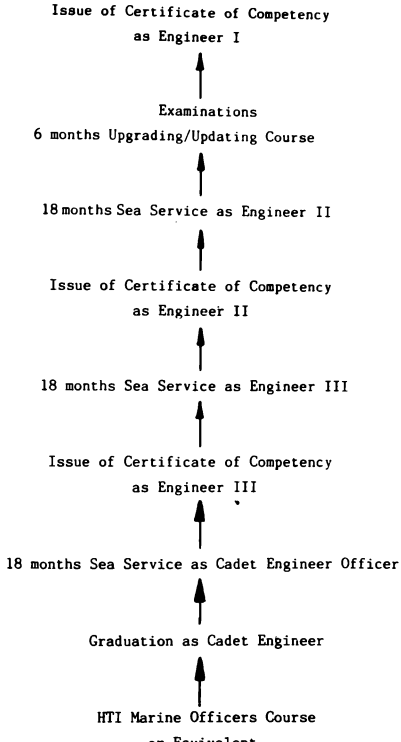
The regulations for Wireless Operators state the requirements for examinations for Class II and Class I Wireless Operators.

The regulations for examinations and certification for Engineer Officers states the requirements for examination of Engineering Cadet and for Engineer Class III, Engineer Class II and Engineer Class I.

Figure 9 shows the requirements of the regulations. The regulations outline the topics which are examinable and these are summarized in Figures 5, 6 and 7 in Chapter VII. The regulations, however, do not provide for a detail syllabus for examinations of engineer officers. It should be noted that the Ministry of Communications and Works has never until now conducted examinations for engine or deck officers.

The 3-year course for Marine Engineer Officers offered by the Higher Technical Institute, already described in Chapter VII,meets the regulations requirements for issuance of Cadet Engineer Diploma.

Figure 9 Certification Structure for Marine Engineer Officers (Existing)



P A R T T W O

GENERAL RECOMMENDATIONS
ON
MARITIME EDUCATION AND CERTIFIFATION FOR THE 1990s.

CHAPTER IX

SEAFARERS POLICY

1. Objectives.

According to a provision of the Cyprus Maritime Law, 15% of the crew of each Cyprus ship should be Cypriots.The main objective of the Cyprus policy on seafarers' matters should be the fulfilment of the above provision of the Law. The government is recommended to introduce regulations and to establish infrastructure for education and training of competent seafarers, to man the Cyprus ships. The education, training and certification, should be in accordance with the requirements of the IMO STCW/78 Convention.

2. Seafarers' Service.

2.1 Establishment.

The first action towards the accomplishment of the requirements of ships' manning legislation and towards the policy objectives of the government, should be the establishment of a service to deal exclusively with seafarers' affairs. Such a service is recommended to be established either directly under the Minister of Communications and Works or under the Director of the Merchant Shipping Department.

The service should be directed and manned by personnel possessing both high academic qualifications and sea experience. Furthermore, the staff of the service should be well aware of the development of shipping technology, of the ships' manning requirements and of the world-wide maritime education trends. Good knowledge of the country's maritime situation is also a very important advantage.

2.2 Activities and Policy of Seafarers' Service.

The activities of the seafarers' service should be inter alia the following:

a. Organization of the existing seafarers.
b. Recruitment.
c. Education and training.
d. Employment.
e. Certification and evaluation for certification.

The service is expected to establish close cooperation and friendly relations with governmental and non-governmental services in Cyprus. It should also create cooperation with similar authorities in other countries and with international bodies concerned in seafarers affairs.

Before the service decides on any serious matter, it is expected to consult all factors who may have special interest on the matter. The establishment of a seafarers' Advisory Commission is recommended. Trade unions, shipowners and governmental services involved in maritime and labour affairs, should be represented in this Advisory Commission. The Commission could discuss policy matters, acting as advisory body to the seafarers service. Any final decision however, should be the responsibility of the government. Specialized committees, such as education and training, and examination and evaluation committees, may also be appointed to assist the service in certain areas where specialized knowledge is required.

3. Registration and Seaman's Book.

A modern complete registration of seafarers, should be introduced by the government. All particulars concerning Cypriot seamen should be recorded in the registration system.

A Cypriot seaman's book should be issued to every Cypriot seafarer, after request. Foreigners employed on board Cyprus ships, should be provided with seaman's books recognized by the Government of Cyprus.

4. Existing Seafarers' Status.

A number of Cypriot seamen are working on board of Greek and other nationalities ships. Many of these seamen are not provided with Cypriot seaman's book and are not recorded in the Cyprus seafarers' registration system. The number of these seamen is not known and information concerning their status is not available. The government should consider the registration of those seamen as matter of high priority and every effort should be undertaken in order to establish contact between the Merchant Shipping Department and Cypriot non registered seamen. The government is recommended to introduce incentives in order to encourage Cypriot seamen to be registered in the Cyprus seamen's registration system and to be employed on Cyprus registered ships. Some of the incentives might be the following:

a. All Cypriot seamen should be provided with a Cypriot seaman's book in which all their previous sea service, which was recorded in previously used documents,is to be transferred. This sea service should be recognized as valid for certification, pension and other purposes.

b. The Cyprus Government is recommended to arrange the problem of contributions of Cypriot seamen on social insurance funds of other countries, by transferring the contributions of Cypriot seamen to the Cyprus social insurance fund system.

c. Special schemes should be introduced to provide economic and other assistance to those seamen who might need such assistance.

d. Special short intensive training courses should be introduced to upgrade and update the theoretical and other knowledge of the existing Cypriot seafarers up to the STCW/78 IMO Convention requirements.

e. The government is recommended to examine the possibility for issuing certificates of service to experienced Cypriot seamen, according to the STCW/78 Convention, Article VII/3. Each case should be considered individually.

5. Recruitment of Seamen.

5.1 Incentives.

Cyprus is a country, without marine tradition, where seafarers do not enjoy high reputation. Therefore, the marine professions are not very attractive

to young Cypriots. It is however necessary to diversify and increase opportunities for employment of young people, among whom unemployment is very high. The sea offers opportunities for many Cypriots to ensure their living, after their studies.

The government should undertake to improve the status of seamen among the society. A good way to succeed in this effort is to inform the public on maritime affairs and especially on the real sea working conditions. Maritime information from national and international sources should be presented to the public by daily and weekly press, after initiative by the Merchant Shipping Department. The government is recommended to consider the introduction of some or all of the following measures in order to attract young Cypriots to seafaring.

a. Creation of adequate maritime education facilities for providing free maritime studies.

b. Ensuring of permanent shipboard employment under safe and good working conditions.

c. Evaluation of the certificates and diplomas of seafarers for the purpose of shore employment in governmental and semi-governmental services.

d. Introduction of a diploma or degree courses for master and chief engineer officers.

e. Reduction of the required national service period for the graduates of maritime institution, under certain conditions.

f. Free medical services for seamen and their families.

g. Social insurance benefits.

h. Free education for the children of seafarers.

i. Tax-free purchasing of movable and immovable property under certain conditions.

j. Permission to maintain external accounts in foreign currency, in Cyprus.

k. Priority for employment in governmental and semi-governmental organizations after a certain number of years at sea.

l. Economic and other assistance for establishment of private business.

The government is recommended to introduce disciplinary measures which should be imposed on disobedient or trouble-making seafarers. Such measures could be the deprivation of privileges, certificates of competency or even deprivation of a seaman's book.

To avoid undesidable situations on board ships, the Department of Merchant Shipping should be reluctant in issuing seaman's book to those persons who have been punished by a Court for criminal offences.

5.2 Number of Seafarers.

The government is recommended to prepare statistics on the total number of Cypriots required for the manning of Cyprus ships. At present, a number of about 3000 seamen are required, in order for every Cyprus ship to be manned according to the manning requirements of the regulations. This number of seafarers should be the target for the seafarers' service of the Merchant Shipping Department.

The annual recruitment could be of about 200 trainees, a number which is approximately equal to the three percent of the annually born male Cypriots.

The following factors should be considered for estimation of the annual recruitment of seafarers.

a. The number of Cyprus ships and the ships' manning requirements.

b. The capacity of the available training facilities and the funds provided for training.

c. The rate of regression and the ability of the country to offer employment to those seafarers who leave the sea.

5.3 Officers and Ratings.

The government should create conditions for training primarily marine officers. The remuneration of marine officers is considerably higher than the average earning in Cyprus, while the income of ships' ratings is about the same as the average income of the craftsmen ashore. This factor, alone, is adequate to justify government's decision in favour of recruitment of officers.

The high cost, of officers' training, at the starting of each course is expected to be reduced during following years when all necessary installations will be established and most of the required equipment will be purchased.

CHAPTER X

EDUCATION AND TRAINING

1. Maritime Training Establishments.

The 1984 manning legislation of Cyprus provides for eighteen specializations and ranks for marine officers and ratings. It is obvious that the government is expected to provide facilities to train seafarers in all these specialities. Special education however, requires the appropriate establishment. The most common practice worldwide is the establishment of maritime academies for officers training and maritime schools for ratings training.

In Cyprus, a maritime academy could provide courses for both; officers and ratings due to the small size of the country and the small number of seafarers required. In addition to the regular courses, a maritime academy could be used for other maritime activities like organization of special courses and seminars, examinations for seafarers etc, a maritime academy however, does not exist in Cyprus and the introduction of such a very costly, in establishing and running, project is out of question at the present time. The political situation in Cyprus, the priorities of the country and the unpredictable future of its merchant fleet, postpone the idea of the Cyprus maritime academy for the future.

The most appropriate solution to the problem of lack of maritime establishments could be the maximum utilization of the Higher Technical Institute for education of marine officers and the use of the Hanseatic Marine Training School for training of ratings. Special courses could be conducted either at the HTI or at the HMTS.

The main advantage of the HTI is the availability of infrastructure in all sectors viz. buildings, equipment, teaching staff and management. The main disadvantages of it are its inland location and its non-maritime character. Furthermore, new investments in equipment and teaching staff are required for the introduction of new maritime courses in the Institute's programme.

The Hanseatic Marine Training School has already established infrastructure for training of ratings and its excellent location is very convenient for

a number of specialized courses like life saving and fire fighting courses. These courses are already introduced in the school's programme.
The Hotel and Catering Institute in Nicosia is the most appropriate place to train ships' catering ratings. No extra facilities or equipment are required and such courses could be provided with very low cost.

2. Courses for Marine Officers.

The main categories of marine officers are deck, engineering and radio officers. The STCW/78 Convention outlines the international requirements for the education and training of the above three categories of officers. Special education schemes have been introduced in almost every maritime country to provide the marine officers with adequate knowledge in order to perform efficiently their duties. In many countries suitable courses for marine electrician officers are also provided. In Cyprus the only available course for marine officers is the marine engineer officers course which is provided at the HTI.

The government is recommended to study the case to introduce additional courses suitable for education of officers. Such courses could be a course for deck officers and a course for electronic/radio officer.
The maritime courses should be highly supported by the government. Every maritime training programme without direct governmental support is liable to suffer from underfunding resulting in lowering of the level of the provided education.

2.1 Master and Deck Officers Training.
At present there are no facilities at all for the training of masters and deck officers in Cyprus. Therefore, the government should consider the introduction of such a course at the HTI,which is the most appropriate establishment for this course.
The introduction of such a course, as well as the introduction of the electronic officer course which is recommended below in this chapter, should be examined within the general maritime policy of the country. Full employment from the first day of graduation should be ensured to the new seafarers.

Deck officers can seek appointment only at sea and there are no opportunities for shore employment for them.

Prior to any final decision, the following points are recommended to be taken into consideration:

a. Entrance requirements should be the same as for the marine engineer officers course. Medical fitness, particularly eyesight and hearing are more important for deck officers than for engineers.

b. The number of students in each year is recommended to be one class (about thirty): a smaller number might be uneconomical.

c. The training programme should be in line with STCW/78 Convention requirements for deck officers, fulfilling at least the requirements of Regulation II/4 for officers in charge of a navigational watch on unlimited size ships.

d. The course is recommended to be of three years duration, like the other HTI courses. The syllabus of the first year might be identical to the syllabus of marine engineer officers course. The second year curricula of the two courses should be slightly different. The engineers' course could be modified and topics like principles of navigation, principles of marine engineering, naval architecture, fire fighting and life saving, might be the same for both courses. Certain subjects like management and maritime law could be the same for both courses in the third year syllabus too. The degree of identification of lessons however, should be examined by the syllabus committees.

e. If the facilities at the HTI are not suitable for some special courses, these courses could be provided either at the HMTS facilities or overseas.

f. A 3-month shipboard summer training between the second and the third year of studies is recommended.

g. Appointment of two competent teachers possessing minimum qualifications, the First Class Captain Diploma, good command of the English language and teaching experience, is suggested.

h. The possibility of IMO assistance in the following areas should be considered:

i. Expertise services for syllabus preparation.

ii. Availability of a training expert for a short period.

iii. Training equipment and text books.

iv. Offer of fellowships.

2.2 Marine Engineer Officers Training.

The marine engineer officers course, which is provided at the HTI, should be considered successful. The high level of education at the HTI and the dual purpose of the marine course, are the main reasons for which the majority of the course graduates, instead of going to sea, continue their studies abroad. Some weaknesses were noticed in the running of the course. These weaknesses however were due to the lack of experience and the scarcity of qualified teachers, the lack of appropriate equipment and the lack of maritime infrastructure. These deficiencies have been gradually reduced to a great extent. The course curricula were modified in 1984 to be in line with Reg III/4 of STCW/78 Convention. Courses in fire fighting and life saving-sea survival techniques are to be provided by the Hanseatic Marine Training School. Two fellowships for masters degree in Naval Architecture/ Marine Engineering and in Maritime Education have been given to staff members. Equipment and machinery were added to the Institute's marine engineering laboratories.

For more efficient running of the HTI marine officers course, are recommended the following:

a. Purchasing of more machinery and equipment.
b. Addition of some kind of simulation in training.
c. Reorganization of the summer shipboard training.
d. Provision of fellowships for updating and upgrading of course teachers.

2.3 Electronic/radio Officer Training.

It is recommended that the Cyprus government examine the possibility for the introduction of a 3-year higher education course for Marine Electronic Officers.The officers should be trained to perform the duties of electronic officer, of radio officer and the duties of electrician aboard ship.
It is well known however, that there are certain objections concerning the needs of future ships in electronic officers and especially the needs of the Cyprus ships. There are also doubts whether is not early for Cyprus to start such a project and whether Cyprus is in position to run the course efficiently.

The following factors should be inter alia considered before taking

any decision.

a. With the generalization of satellite communication in 1990's, the role of radio officer on board ships is limited. Some of the duties however, of the radio officer, will remain and it is not sure whether the master and the ship's deck officers will be in position to undertake these additional duties.

b. Electronic equipment is spread throughout the ship; navigation, communication, engine and machinery systems are already based, or they will be based very soon, on electronics and electronic controls. Therefore, there will be a need for a highly specialized electronic officer who should be able to identify any electronic failure, and to restore the failed system as soon as possible.

c. Deck, engineering officers and electricians may have good knowledge on electronics but they will never be specialists without expensive and extensive specialized training.

d. The role of electricians as repairman of conventional electrical equipment is constantly limiting. Every day more and more electrical hardware is converting to electronic. There is need therefore, for electricians to be trained in electronics, following the development of electrical equipment to electronic. If the electrician who has been well trained in electronics, undertakes the remaining duties of radio officer, the electronic officer is introduced. It could be possible however, to have a radio officer who is already required to have a good knowledge in electronics, to be trained to perform the electrician's duties. The results in both cases is an electronic officer who is trained to carry out the duties of a radio officer, the duties of an electrician and the duties of an electronic officer.

e. The ships flying the Cyprus flag should be renewed in order to survive in this highly competitive shipping business. The operation of all new ships is based in electronics. Furthermore, if we are planning,now, to introduce the course, the electronic officers will be available for employment in seven to ten years time (two years planning, plus three years studies, plus two years national service).

f. The infrastructure required for training marine electronic officers, is almost available at the HTI. The first two years the students could follow the electrical engineering course. Subjects suitable for shore installation might be replaced by ship description and construction, marine engineering

and navigation. Main subjects for the third year should be control engineering, marine electronics, communications, morse signals etc. The course however, should be planned by specialists.

g. There are some plans for introduction of an electronic engineering course at the HTI. In such case, the operation of a marine electronic officer course becames easy.

2.4 Simulation Training.

Simulation training has been introduced relatively recently in maritime training as compared to aviation training.This training became very popular because of its certain advantages. The most common training of this type is with navigation, radar, engine and cargo handling simulators. Many other simulators are also used, simulating almost every aspect of ship operation. The purchase of any simulator however, is very expensive. The Government of Cyprus is not expected to invest 200-300 thousand USA$ in purchasing a common engine simulator, in order to train 30-50 students and seafarers for a week of simulation training each year. Therefore, for Cyprus there are the following possibilities for simulation training:

a. To purchase second hand simulators in good condition and low price, if there are available in the market.

b. To introduce only software simulation training with the aid of computers, solution which is recommended.

c. To rely upon foreign training simulation centres for training only the students who will go to sea after graduation.

2.5 Summer Shipboard Training.

The summer shipboard training is conducted between the second and third year of studies for the marine engineer officers course and it is recommended for future deck officers and electronic officers courses.

The HTI provides the students with detailed training log-books and prepares quidelines for the ships' officers who supervise the training. The Institute however, meets many difficulties to secure the required number of places within the limited summer period. For this reason it is recommended the task to be undertaken by a service which has direct contact with the shipping industry.

The Merchant Shipping Department is the only governmental service which

has contacts with shipping factors and it can exercise influence for securing the adequate number of places required. More specifically, the following are recommended:

a. The positioning of students on board ship to be undertaken by the Merchant Shipping Department in cooperation with the Higher Technical Institute.

b. For elimination of the financial problems, it might be necessary to establish a training fund into which the government and the Cypriot shipowners will contribute. This fund should be used for covering the students' travelling expenses. It could be a good idea if such a scheme was extended to cover other sectors of maritime training, like purchasing of equipment.

c. The shipowners should be invited to participate in the HTI activities. Representative of shipowners could be member of the Institute's board of governors, participating in meetings when matters concerning maritime courses are discussed.

2.6 Recruitment of Students.

The existing method for selection of students for the HTI marine officers course is satisfactory. The method, which consists of medical fitness and entrance examinations, ensures the selection of high level students. This system could be used for the selection of students of all future maritime courses. Some very good pupils who wish to became marine officers avoid participating in the examinations because of lack of the right information about seafaring. A campaign should be undertaken in order to inform the secondary school pupils and their families about the seafaring reality and the benefits of the sea.

3. Training of Ratings.

The 1990's ships are expected to be sailing with less than 15 members of crew. It is therefore inevitable, officers and ratings to be trained in a kind of polyvalent system in order to be able to perform many different duties on board ships.

The Cyprus Government is recommended to examine the possibility to introduce combined training courses for deck/engine ratings and steward/cook ratings.

The ratings training programme should be divided in three parts as follows:

a. Pre-sea training for six months.

b. Shipboard practical training and service for 24 months.

c. Final training for four months.

The outline of the training is shown in the following block diagram:

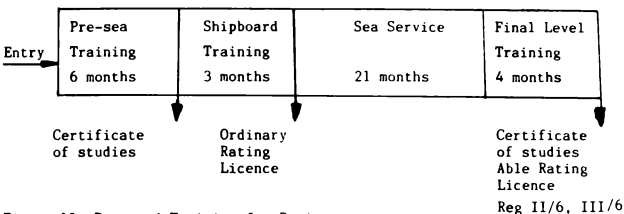


Figure 10 Proposed Training for Ratings.

The candidates for pre-sea training should be between 16 and 30 years of age and they should pass medical and simple entrance examinations.

3.1 Training of Deck/Engine Ratings.

This training should be in accordance with the combined requirements of the STCW/78 Convention Reg II/6, III/6 and Resolutions 8 and 9.

The courses could be conducted in the Hanseatic Marine Training School or in any other appropriate school which might be built in the future.

a. Pre-sea training.

The pre-sea training for deck/engine ratings should include elementary mathematics and physics, basic mechanics and materials, fundamentals of ship and engine description, principles of navigation, principles of engine operation and English. Practical training like seamanship, workshop practice and maintenance of machinery should also be provided. Life saving and survival at sea and fire-fighting courses should be included in the training programme.

Examinations could be conducted during the training and at the end of the courses. Students who successfully attend the course, should be provided with certificates of studies.

b. Shipboard Training and Service.

The shipboard practical training should follow the pre-sea training. During this training the trainee works on board ship as assistant to ship's officers. The Master, assisted by the Chief Mate and the Chief Engineer, should supervise the training. The school could provide each student with a program of training which might be followed as closely as possible.

After a successful 3-month shipboard training, the trainee should be provided with an Ordinary Marine Rating Licence.

The trainee should continue his sea service as ordinary rating for another 21 months. The sea service period should be carried out in both deck and engine departments. It will be no problem if the service is conducted on board ships which employ general purpose ratings. If the ship is manned in the conventional way, then the rating should have not less than nine months service in one of the two departments, deck or engine. At least 24 months sea service should be required for entering the high level course.

c. High Level Course.

After the completion of the 24-month shipboard training and service, the rating could go back to the ratings school for a 4-month final theoretical training.The subjects of the pre-sea course should be taught at the final course but in a higher level. During the course, the trainee should be examined but main examinations should take place at the end of the studies. The successful students should be given certificates of studies and Able Marine Rating Licence. The licence should be valid for work on board of any ship. The able marine rating should be able to perform the duties of deck rating or engine rating, or the duties of both as polyvalent deck/engine rating.Ratings with sea service either in deck or in engine departments only, should be provided with the Able Marine Rating Licence with limitations.

In case of employment on board tankers or on board of hazardous cargo carriers, the rating should attend special courses as specified by the relevant STCW/78 Convention Reg V/1/2/3.

3.2 Training and Catering Ratings.

a. Pre-sea Training.

The catering ratings should follow a six months pre-sea course at the Hotel and Catering Institute in Nicosia. The Institute has already programmes

for training hotel personnel. Similar programmes could be followed and for ship cook/stewards. The trainee should learn basic mathematics, English, cookery, bread making, bakery, galley and mess room work, provisions and stores, food resources and hygiene.

Before the graduation, the students should attend special courses in life saving, personal survival techniques and fire fighting courses. These courses could be conducted at the HMTS. After exams, the rating should be provided with certificate of studies.

b. Shipboard Training and Service.

The shipboard training could be analogous to the deck/engine ratings training, viz. in 3 months to be provided with Licence of Ordinary Catering Rating and in 24 months to have the right to attend final course for catering ratings. The training, which is to be supervised by the ship's Master assisted by ship's Catering Ratings, should include both cook and steward duties. Out of the 24 months shipboard training, at least nine months should be either galley or mess room duties in ships where such duties are separated.

c. High Level Course.

After the completion of the 24 months shipboard training and service, the rating should go back to the Hotel and Catering Institute for a final course. During the course which should last for about four months, the same subjects as to the pre-sea course could be taught, but in more advanced levels. After examinations, the trainee should be provided with certificate of studies and Able Marine Catering Rating Licence. The licence should be valid for catering duties on board of any merchant ship. If the galley or mess room training is not adequate, the rating should be given Licence with limitations.

4. Special Courses.

In addition to general education for cadet officers and ratings, a number of special and specialized courses are also required by the STCW/78 IMO Convention. The most important of these courses are the following:

a. Fire fighting courses.

b. Life saving and survival techniques courses.

c. First aid courses.

d. Proficiency in survival craft courses.

e. Tanker, chemical carriers and liquefied gas carriers familiarization courses.

f. Operation courses for tankers, chemical carriers and liquefied gas carriers.

Updating and upgrading courses should also be organized. Regulations II/5, III/5 and IV/2 provide for continuation of proficiency courses. Simulation training and new equipment familiarization courses are recommended to be organized. The introduction of special examination preparation courses and/or courses to replace examinations should be considered.

Special courses which do not require sea environment should be conducted at the Higher Technical Institute. Courses of practical nature could be provided at the Hanseatic Marine Training School.

The cost for establishing and running certain very specialized courses might be very high. In such cases, it is prefarable for Cypriot seafarers to be assisted in taking such courses overseas, instead of establishing the courses in Cyprus.

5. Diploma Course.

The Government of Cyprus should examine the possibility of introducing at the Higher Technical Institute a Diploma course, equivalent to degree course, for marine officers who possess highest sea-going certificates.

The course is recommended for the following reasons:

a. To provide opportunities to seafarers for highest education and better employment.

b. Many young people could be attracted to maritime professions if possibility for highest education is offered.

c. The number of the HTI Marine Engineer Officers course graduates, who follow highest studies abroad exactly after graduation, is expected to be eliminated. The students could continue at sea for some years if they have the opportunity to attend degree course in their country, later on.

d. The course could provide highly qualified personnel for shipping companies, maritime schools, governmental and other services.

The Diploma course should be very well prepared and planned. Entrance requirements could be highest sea-going certificates and very good knowledge in mathematics, other scientific subjects and English. The number of students should be very low.
The course should be of, at least, nine months duration.
The main subjects could be maritime economics and management, marine engineering, marine electronics and control engineering. Narrow specialization within the course might be possible.

6. Educators.

6.1 Recruitment and Training.

Recruitment of educators should be based only on qualifications. No other means should be considered.
In a small country like Cyprus, where resources are limited, priority should be given to attract and retain an adequately qualified teaching staff. It is better to have good teachers and poor physical facilities, rather than good physical facilities and ineffective teaching staff.

Teachers of non purely technical maritime subjects i.e. mathematics, physics, mechanics, maritime law, are recommended to be recruited among people possessing a university degree in their specialization, teaching and professional experience.
Educators who teach purely maritime topics, like navigation and marine engines, should be selected among seafarers possessing highest sea-going certificate of competency. Seafaring background is very important for teachers of maritime subjects.

Maritime educators should be assisted either before or after their recruitment, to obtain degree qualifications. Teachers without teaching experience should be trained in teaching methods.

6.2 Updating of Educators.

Updating of knowledge is considered the main problem for technical educators. In many small countries, maritime education is provided by only one

CHAPTER XI

PROPOSED EXAMINATION AND CERTIFICATION FOR ENGINEER OFFICERS

1. Introduction.

For reasons explained in the preceding chapters, the Cyprus Government should proceed with the development and implementation of a system capable to handle examination and certification of Cypriot and alien seafarers. In the course of the preparation of this system the planners should consider the following:

a. The provisions of the legislation should be based on the STCW/78 Convention, as well as on the associated resolutions and recommendations. Any possible additional national requirements should also be considered.

b. The regulations to be introduced should be simple, clear, explicit, fair and consistent.

c. Main objectives of the system should be minimum number of certificates, safety of life at sea and preservation of property and environment. The manning of the present and future Cyprus flag vessels with capable, competent and efficient seamen should be the final result.

d. Maximum utilization of existing educational facilities and infrastructure should be made.

e. Similar systems, in other countries, preferably of the Commonwealth group, since Cyprus was a British Colony, should be studied in an effort to detect unwanted patterns and implications.

f. The system should be flexible for continuous upgrading and updating in order to keep abreast with the developing shipping technology.

The certification system which is described below, in this chapter, is in accordance with the requirements of Chapter III of the Annex to the STCW/78 Convention. The system is an amalgamation of provisions of systems introduced by other countries. New concepts and ideas however, have been introduced in many of its provisions.

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2. Certification of Engine Department Personnel.

2.1 Grouping of Vessels.

The STCW/78 Convention outlines the requirements for education, training and certification of engineer officers and engine ratings, for two groups of vessels. The criterion for determining the group in which a vessel belongs is the propulsion power rating. This, however, has divided the world fleet into three groups, as follows:

Group 1: ships powered by machinery having propulsion power above 3000kw

Group 2: ships powered by machinery having propulsion power between 750 kw and 3000 kw

Group 3: ships powered by machinery having propulsion power below 750 kw.

It appears that a lower range limit for the propulsion power of group 3 needs to be defined. The Government of Cyprus, when determining this range limit, should consider the characteristics of the Cyprus vessels and their trade as well as policies adopted by other countries on this issue. For the purposes of this chapter group 3 vessels are those having machinery of propulsion power between 350 kw and 750 kw.

2.2 Classes of Certificates of Competency.

The regulations should provide for the following classes of certificates for Engineer Officers and Ratings:

1. Marine Engineer Officer - Class A
2. Marine Engineer Officer - Class B
3. Marine Engineer Officer - Class C
4. Marine Engineer Officer - Class D
5. Assistant Marine Engineer Officer
6. Able Engine Rating
7. Ordinary Engine Rating

Due to traditional reasons the term 'Certificate of Competency', since this is a professional certificate, should be used. Other terms, such as 'Diploma', are usually associated with degrees awarded by academic institutions and are not recommended. Either letters of the alphabet or Latin,

or Arabic numbers, should be used to designate the classes of the certificates. Terms such as 'Chief Engineer Certificate' or 'Second Engineer Certificate' should be avoided as the former part of them describes a post and not a qualification.

The Engineer Class D certificate is equivalent to the Cyprus Merchant Shipping (Master and Seamen)Law Practical Engineer Licence already described in Chapter VIII. This class of certificate is introduced in order to fulfil the needs in officers of small vessels. An Able Engineer Rating may receive the Engineer Class D certificate after meeting the necessary qualifications. This option offers the ratings an opportunity to proceed through the officers' ranks.

2.3 Conditions for Issue of Certificates.

a. Engine Rating.

The requirements for the issue of the Engine Rating certificates have been already presented in Chapter X, under Training of Ratings.

b. Engineer Officers.

The proposed engineer officers certification structure is shown in Figure 11.

The requirements to be met by seafarers are as follows:

I. Engineer Officer Class D.

Every candidate wishing to qualify as Marine Engineer Officer Class D should satisfy the Administration that he:

(a) has academic qualifications of a standard which shall be not lower than that of a school leaving certificate of a secondary education or a technical school;

(b) is a holder of an Able Engine Rating Certificate;

(c) has accumulated a minimum of three years shipboard experience after receiving the Able Engine Rating Certificate whilst performing duties relevant to his certificate;

(d) has passed examinations approved by the Administration.

II. Engineer Officer Class C.

Every candidate wishing to qualify as Marine Engineer Officer Class C

should satisfy the Administration that he:

(1) (a) has academic qualifications of a standard which shall be not lower than that of the Diploma of Marine Officer in Engineering awarded by the Higher Technical Institute;

(b) has accumulated a minimum of one year shipboard experience as an assistant engineer officer, of which a period of six months must have been on board vessels of the group wishing to qualify,

or

(2) (a) is a holder of Marine Engineer Officer Class D Certificate of Competency;

(b) has accumulated a minimum of two years of shipboard experience after receiving the Marine Engineer Officer Class D Certificate, of which a period of one year must have been on board vessels of the group wishing to qualify;

(c) has passed examinations approved by the Administration,

or

(3) (a) is a holder of relevant engineering degree from an accredited University or Polytechnic;

(b) has had at least four months pre-sea training;

(c) has accumulated a minimum of one year of shipboard experience as an assistant engineer officer of which a period of six months must have been on board vessels of the group wishing to qualify;

(d) has passed examinations approved by the Administration.

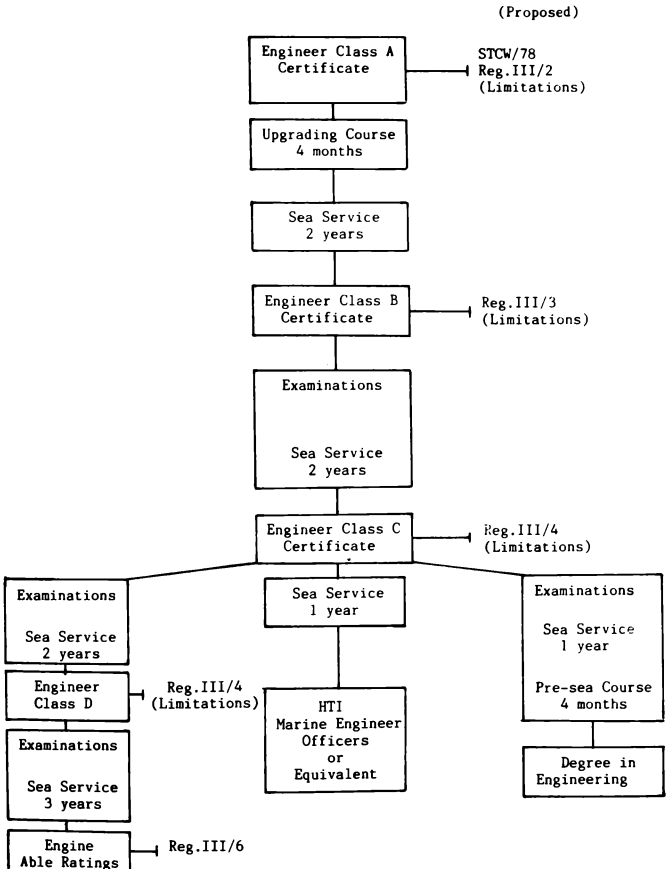
III. Engineer Officer Class B.

Every candidate wishing to qualify as Marine Engineer Officer Class B should satisfy the Administration that he:

(a) is a holder of a Marine Engineer Officer Class C Certificate of Competency;

(b) has accumulated a minimum of two years of shipboard experience as an engineer officer, after receiving the Marine Engineer

Figure 11 Certification Structure for Marine Engineer Officers



Officer Class C Certificate, of which a period of one year must have been on board vessels of the group wishing to qualify;

(c) has passed examinations approved by the Administration.

IV. Engineer Officer Class A.

Every candidate wishing to qualify as Marine Engineer Officer Class A should satisfy the Administration that he:

(a) is a holder of a Marine Engineer Officer Class B Certificate of Competency;

(b) has accumulated a minimum of two years of shipboard experience as an engineer officer, after receiving the Marine Engineer Officer Class B Certificate, of which a period of one year must have been on board vessels of the group wishing to qualify;

(c) has successfully completed an approved post-sea updating and upgrading education of at least four months duration.

It should be noted that the material examinable for the various classes' certificates is presented in an objective form in the appendix of this study.

Additionally, specialized courses might be required as prerequisities for issuing any of the above certificates.

Furthermore the seafarers should be holders of valid Seaman's Book and have a clear criminal record.

It is suggested that the Administration considers the imposition of minimum age limit requirements for the various classes of certificates.

2.4 Calculation of Sea Service.

The existence of three groups of ships necessitates the development of a set of formulas for computing the accumulated sea services, which will ensure an objective and fair calculation of the seafarers' sea service. The principle idea is that the more complex and bigger in size a machinery plant is, the deeper the knowledge and the skills of its operation will be:

Propulsion Power Groups		
Group 1 above 3000 kw	Group 2 750 to 3000 kw	Group 3 350 to 750 kw
$A=M+G1+a.G2+b.G3$	$A=M+\frac{G1}{a}+G2+a.G3$	$A=M+\frac{G1}{b}+\frac{G2}{a}+G3$

Table V Formulas for the calculation of accumulated sea service.

Meaning of the symbols in Table V is as follows:

A :Accumulated sea service.

M :Mandatory period of service on board the particular group of vessels, as defined in the conditions for issue of certificates.

G1:Service period on board of group 1 ships (large size ships).

G2:Service period in board of group 2 ships (medium size ships).

G3:Service period on board of group 3 ships (small size ships).

a and b: Service weight coefficients.

The value of these coefficients should be determined by the government after discussions with all interested parties as this issue is a delicate one. Values such as 0.8 and 0.6 respectively appear to the writer as reasonable ones.

Half of the service at shipyards or engine repair or building works or the attendance of specialization or updating or upgrading courses, might be considered as shipboard experience up to a maximum of 25%, of the required by the regulations accumulated sea service.

2.5 Capacity of Certificates.

A study of the conditions for issue of certificates shows that the class requirements are the same for all groups of ships. A certificate of a certain class for which an engineer is qualified, provides him opportunity to work according to his class on board ships of a certain group for which his certificate is valid, as follows:

a. Engineer qualified for group 1 ships is allowed to work on board of any vessel (unlimited certificate).

b. Engineer qualified for group 2 ships is allowed to work on board of groups 2 and 3 ships only (one limitation certificate).
c. Engineer qualified for group 3 ships is allowed to work only on board of group 3 ships (two limitation certificate).
The holder of a certificate of certain class however, who is qualified for service on board ships of a certain group should be allowed to work on board ships of other groups under certain conditions.

Noting the above and bearing in mind the characteristics of the three groups of ships it is recommended that Engineer Officers should be allowed to work on board all ships as follows:
a. An Engineer Officer Class A - group 1 may serve at the post of Chief Engineer on board all ships.
b. An Engineer Officer Class A - group 2 may serve at the post of Chief Engineer on board of group 2 ships or as Second Engineer on board a group 1 ship.
c. An Engineer Officer Class A - group 3 may serve at the post of Chief Engineer on board ships of group 3 or as Second Engineer on board ships of group 2 etc.
The Table VI illustrates this idea and shows the various options available.

However, it should be noted that
a. service on board certain types of ships such as tankers, product, or chemical carriers may require specialized training; and
b. service on board passenger ships or ships transporting goods of hazardous nature may require Engineer Officers to hold certificates of a higher class than the one shown in the Table VI.

2.6 Conditions of Movement of Officers between Groups of Ships.
It appears necessary to specify the conditions under which officers qualified for service on board ships of one group are allowed to work on board ships of another group.
Figure 12 shows the various options which may be followed and gives also the minimum additional sea service required.
The governing principles for the above are:
a. An Engineer Officer qualifies for the next lower class of certificate

Group 1	Group 2	Group 3
Class A Chief Engineer	Chief Engineer	Chief Engineer
Class B Second Engineer	Chief Engineer	Chief Engineer
Class C Watchkeeping Engineer	Second Engineer	Chief Engineer
Class D Assistant to Watchkeeping Engineer	Watchkeeping Engineer	Second Engineer
Second Engineer	Class A Chief Engineer	Chief Engineer
Watchkeeping Engineer	Class B Second Engineer	Chief Engineer
Assistant Engineer	Class C Watchkeeping Eng.	Second Engineer
Assistant to Watchkeeping Engineer	Class D Watchkeeping Eng.	Watchkeeping Engineer
Watchkeeping Engineer	Second Engineer	Class A Chief Engineer
Assistant Engineer	Watchkeeping Eng.	Class B Second Engineer
Assistant Engineer	Assistant Eng.	Class C Watchkeeping Engineer
Assistant to Watchkeeping Engineer	Assistant to Watchkeeping Eng.	Class D Watchkeeping Engineer

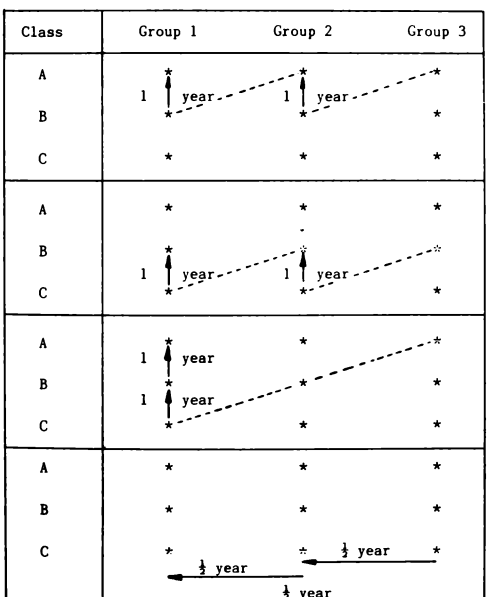
Table VI Capacity of Marine Engineer Officers certificates

at the next higher propulsion group;

b. in order to reach the same class as on the lower group, the Engineer Officer is required to have the shipboard experience required by the regulation for promotion in the group between the two classes of the same group.

Exceptionally, the holder of a Marine Engineer Officer Class C Certificate of the group 3 ships requires only six months of shipboard experience to qualify as Engineer Officer Class C of either of the other two groups, see Figure 12. Engineer Officer Class C of the group 2 ships requires six months to qualify as Engineer Officer Class C of the group 1 ships.

Figure 12 Conditions of Movement of Engineer Officers between Groups of ships.



2.7 Certificates of Service.

It is recommended that the Government of Cyprus proceeds as soon as possible in the issuing of Certificates of Service to existing seafarers according to the provisions of the Article VII of the STCW/78 Convention.

3. Examinations.

3.1 Establishment.

Taking into consideration that examinations are a main requirement of the STCW/78 Convention, the government should establish, as soon as possible, a system for examination of seafarers. In our opinion, the examination task should be undertaken by the seafarers' service, which we have already suggested in Chapter IX of this study.

A qualified officer should be permanently appointed to be in charge of the examination system of the country. Examiners could be qualified governmental officials appointed on temporary basis to carry out the examiners' duties. In Cyprus, the Higher Technical Institute is the most appropriate place for conducting seafarers examinations for certification.

3.2 Examinations Regulations.

Regulations should be introduced to cover every aspect of the examinations. The Regulations should provide inter alia for examinations prerequisites, syllabuses, qualifications of examiners, types of questions, procedures of examinations and marking of papers.

3.3 Syllabuses.

The Merchant Shipping Department should prepare and approve syllabuses for examinations of seafarers. The STCW/78 Convention provides for minimum knowledge requirements. Attached as an Appendix to this study is a proposed syllabus for examinations of Engineer Officers.

The approved examination syllabuses should be published a long time before the examinations' dates and should be available from the Department's headquarters and from all the Cyprus Embassies. The syllabuses could be updated every year by an examination committee.

3.4 Subjects.

The examinable subjects are listed by the Convention. The subjects could be grouped according to their content. Each day of examinations, subjects of the same group should be examined. Written examinations should be required for theoretical subjects. Oral or written examinations might be required for subjects of practical nature.

Provisions should be made to allow the candidates to complete the examinations in more than one attempts.

Subjects which were successfully examined should be credited. Credits so gained should be valid for a limited period of time.

3.5 Preparatory Courses and Maritime Library.

The Department is expected to examine the possibility to introduce examinations preparatory courses if the demand among seafarers for such courses is high.

Bearing in mind that maritime books are not easily found in Cyprus, the establishment of a maritime library should be considered by the Administration.

3.6 Questions and Answers.

The examination questions should be prepared by examiners. Model answer could be prepared for each question. Multiple choice or essay type questions should be considered. The candidate should be aware of the type of questions before the day of examinations. A number of questions could be prepared, out of which the final ones might be selected.

Misprints, wrong numbers and other omissions in the examination questions should be in favour of the candidate.

3.7 Admission.

Each candidate seeking admission to examinations should be required to complete and sign an application form. The completed form and the required supporting documents should be submitted to the Department before the day of examinations.

3.8 Violation of Examination Rules.

The identification of the candidates should be verified to avoid fraud

and misrepresentation. A candidate who violates any of the examination rules should be considered to have failed and should not be accepted for re-examination, for a certain period.

3.9 Passing Marks and Re-marking of a paper.

A candidate should take no less than fifty percent of the marks in each subject, in order to secure a pass.

A candidate should be allowed to request in writing for re-marking of his paper.

3.10 Examinations Dates.

Examinations for each class should be conducted twice a year. Dates for examination should be announced ahead of time and should be available from the Department's headquarters or from all the Cyprus Embassies.

3.11 Examination of Aliens.

Taking into consideration the nature of the crews of the Cyprus merchant fleet, it could be necessary to conduct examinations for aliens in places outside Cyprus. The matter, however, requires very careful study. Previous practice followed by other countries, with similar problems, could be very helpful.

CHAPTER XII

CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

1. Conclusions.

a. All sectors of Cyprus economy were developed during the post-independent years. In terms of shipping great success has been made in establishing services and facilities. So, the Cypriot Register of Merchant Ships showed a continuing growth both in number of vessels registered as well as in terms of tonnage, during the last few years.

b. The Cyprus Government in its efforts to improve the standards of the Cyprus flag vessels has ratified the STCW/78 Convention recently and has introduced legislation concerning minimum safe manning requirements, last year. These, coupled with the existing statutory requirement that at least 15% of the crew of each Cyprus ship should be Cypriots, establish a definite need for the recruitment, education, training, examination and certification of Cypriot seafarers.

c. In spite of the fact that during the ancient times Cyprus has been one of the sea dominating nations, its present population has not been attracted to the sea oriented trades.

Consequently, as it is quite common in most of the developing countries, there is no service to handle and coordinate the existing seamen affairs, nor to look after their welfare.

Furthermore, there is no service to administrate the registration, examinations and certification of Cypriot seafares. This provides an excellent opportunity to develop the sea trades under highly regulated and controlled conditions.

d. The Higher Technical Institute in Nicosia offers, with success since 1976, a course for Marine Engineer Officers which meets the STCW/78 Convention requirements. This Institute offers also a course for electrical engineers and at present a study is conducted for introducing a course in electronics.

The Hanseatic Marine Training School in Limassol, offers courses for engine, deck and catering ratings.

The Nicosia Hotel and Catering Institute could offer courses to catering

ratings for satisfying demand from Cyprus shipping.
Two private establishments provide radio officers courses.
Training courses for deck officers do not exist in Cyprus.

2. Summary of Recommendations.

Noting the need of the Cyprus merchant navy for qualified and certificated Cypriot seamen and bearing in mind the general and maritime infrastructure, it is recommended that the Government of Cyprus attends to the following:

a. Establishes a specialized service, preferably within the Department of Merchant Shipping, to administer all the seamen affairs. In particular the service should deal with the selection, education and training, examination, certification and registration of seamen, as well as their welfare.

b. Determines the anticipated number of competent certificated Cypriot seamen required to man the Cyprus flag vessels, as well as the demand per department.

c. Introduces legislation for the registration of seamen. Special considerations should be given in amalgamating existing seafarers educated and certificated abroad.

d. Observes the actions taken by other maritime nations, especially the developed ones, in implementing the STCW/78 Convention for their own merchant navy.

e. Develops and establishes incentives in order to attract young people to the challenging and rewarding seafaring.

f. Considers introducing the necessary courses for educating deck and radio officers as well as catering personnel.

g. Commissions the necessary studies and commences the preparations for establishing officers upgrading courses.

h. Monitors closely the changes in shipping technology and promplty updates the courses offered.

i. Proceeds immediately with the structuring of the seamen examinations and certifications procedures bearing in mind, at all times, the problems which are relevant with the Cypriots and their environment.

j. Endeavours to obtain funds for technical assistance needed from IMO or other sources.

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Consultant's Assignment Reports after MISSIONS in Cyprus.

i. P.S.Vanchiswar, Inter-regional Consultant in Maritime Safety Administration.
Consultative services Relating to Maritime Safety Administration.
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Inter-regional Advisory services in Maritime Training. Mission 2-10 February 1984.

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Kluwer Publishing Limited
United Kingdom, 1983

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A P P E N D I X

SYLLABUS
FOR CERTIFICATION EXAMINATIONS
OF MARINE ENGINEER OFFICERS.

ANDREAS C. LOIZIDES
CYPRUS.

TABLE OF CONTENTS

INTRODUCTION

This appendix is a draft of an examination syllabus for the Marine Engineer Officers. It was developed, following a request received from the Department of Merchant Shipping of Cyprus.

The pages, which follow, give a rather detailed identification of the subjects examinable for the four classes of certificate of competency. It should be appreciated that the preparation of the syllabus in this form, presented a considerable number of difficulties. It proved to be a tedious job and it requires an in depth and detailed knowledge of the material.

The work was developed (a) based on the requirements by the STCW/78 Convention (b) following a study of systems in use by other maritime nations and (c) after reviewing and scrutinizing a large number of relevant textbooks and other technical publications.

The syllabus is presented in an objective form in order to assist seafarers in the study and preparation for the examinations, whether this is to be done on board or ashore. It may also assist the examiners in setting up the examination papers.
The candidates should be aware that the statements as written in the appendix are not necessarily examination questions. Many are of a general nature providing for the examiner to form a number of examination questions out of each statement. Some others are very specific and they could be set in an examination paper as they are formed in the appendix.

Certain subjects, for example mathematics, whilst not examinable in a number of countries and not even required by the STCW/78 Convention, are included because, in the opinion of the writer, they are important for engineer officers. Proficiency in a number of other subjects, such as fire fighting and life saving appliances, could be verified during an appropriate course followed by examinations.

The writer anticipates that a number of shortcomings may be found in this syllabus, as he has not an in depth knowledge of all the subjects. He believes however, that this appendix may form the working draft of an ad hoc committee assigned to the task of formulating the final version of the syllabus.

CHAPTER I

MATHEMATICS

List of Topics:

A. Arithmetic.
B. Algebra.
C. Logarithms.
D. Graphs and Graphical methods.
E. Mensuration of Areas and Volumes.
F. Trigonometry.
G. Complex Numbers.
H. Calculus.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Arithmetic.				
1. State the basic measurements of S.I. units.			*	*
2. State scientific notation for powers of 10.			*	*
3. State and apply units for length, area, volume, velocity, mass, force, pressure, energy and power.			*	*
4. Evaluate arithmetic expressions (addition, subtraction, multiplication and division) of real numbers (integers, decimals and fractions).			*	*
5. Evaluate exponential expressions.			*	*
6. State powers of unity and zero.			*	*
7. Define radicals.			*	*
8. Transfer radicals to exponentials and vice versa.			*	*
9. Evaluate radical expressions.			*	*
10. Define ratio, proportion and variation.			*	*
11. Solve problems expressing ratio, proportion and variation.			*	*
12. Apply method of unity in solving problems.			*	*
13. Define percentage and solve problems expressing percentage.			*	*
14. Define average and solve problems expressing average.			*	*

		A	B	C	D
B.	**Algebra.**				
a.	Elementary algebra.				
1.	Define algebra and algebraic expressions.			*	*
2.	Apply algebraic rules to manipulate operations (addition, subtraction, multiplication, division, collection of terms).			*	*
3.	Factorize expressions.	*	*	*	*
4.	Manipulate algebraic fractional operations involving factorization.			*	*
5.	Evaluate algebraic expressions.		*	*	*
b.	Equations.				
6.	Define equations.			*	*
7.	Solve simple equations (first degree - one unknown).			*	*
8.	Solve problems involving simple equations.	*	*	*	*
9.	Solve logarithmic equation.	*	*	*	*
10.	Solve simple simultaneous equations.	*	*	*	*
11.	Solve quadratic equations.	*	*	*	*
12.	Solve simultaneous quadratic equations.	*	*	*	
13.	Solve problems involving quadratic equations.	*	*	*	
14.	Solve cubic equations.	*	*		
c.	Series.				
15.	Define series.			*	*
16.	Define arithmetic progression (AP).			*	*
17.	State and apply general term and sum of an arithmetic progression.	*	*	*	*
18.	Define geometric progression (AP).			*	*
19.	State and apply general term and sum of a geometric progression (GP).	*	*	*	*
20.	State binomial series (theorem)	*	*	*	
21.	Describe Pascal's triangle.	*	*	*	
22.	Express binomial theorem by combination notation.	*	*		
d.	Determinants and Matrices.				
23.	State the purpose of determinants.		*		

	A	B	C	D
24. Apply determinants to solve simultaneous equations.	*	*		
25. Define a matrix.		*		
26. State and apply rules for addition, subtraction and multiplication of matrices.	*	*		
27. Solve problems by matrix and matrix inverse method.	*	*		

C. Logarithms.

1. Define logarithm.			*	*
2. State the laws of logs.		*	*	*
3. Using four figure logarithm and antilogarithm tables of common logs, evaluate expressions involving multiplication, division, powers and roots.		*	*	*
4. Define Napierian or natural logs.			*	
5. Define logarithms to any base.		*	*	*
6. State base changing rule.		*	*	
7. Convert logs to one base to logs to another base.	*	*		
8. Solve problems involving Napierian logarithms.		*		
9. Evaluate expressions and solve problems involving multiplication, division, powers and roots to common and natural base.	*			

D. Graphs and Graphical methods.

1. Describe the graphical representation between two quantities in cartesian system.			*	*
2. Derive general equation of a straight line.	*	*	*	
3. Describe gradient of a straight line.	*	*	*	
4. Define asymtotes.		*	*	
5. Define the gradient at any point of a curve.	*	*		
6. Convert simple relationship to linear form.	*	*		
7. Solve simultaneous linear equations graphically.	*	*	*	
8. Solve quadratic equations graphically.	*	*		
9. Solve simultaneous quadratic equations graphically.	*	*		

	A	B	C	D
10. Explain the difference between log-linear graph paper and log-log graph paper.	*	*		
11. Solve graphically equations of the form $PV^n = C$, using logs.	*			
12. Plot graphs on polar graph paper.	*			

E. Mensuration of Areas and Volumes.

1. Define areas of triangles, parallelogram, trapezium, rhombus, polygons, circle and ellipse.			*	*
2. Define circumferences of circle and ellipse.			*	
3. Calculate areas of triangles, parallelogram, trapezium, rhombus, polygons, circle and ellipse.		*	*	*
4. Define areas of circular ring, segment and sector.			*	
5. Define surface areas of cylinder, sphere, cone and pyramid.			*	*
6. Calculate areas of circular ring, sector and segment.		*		
7. Illustrate and apply theorem of Pappus or Gultinus to surface areas of solids of revolution.	*	*		
8. Calculate surface areas of cylinder, sphere, cone and pyramid.		*	*	*
9. Calculate surface areas of frustrum of cone and pyramid.		*		
10. Calculate surface areas of circular ring of circular and elliptical sections.		*		
11. Illustrate and apply trapezoidal rule to calculation of areas.	*	*	*	
12. Illustrate and apply Simpson's first rule to calculation of areas.	*	*	*	*
13. State volumes of cylinder, sphere, cone and pyramid.			*	*
14. Illustrate Simpson's first rule for volumes.			*	*
15. Calculate volumes of cylinder, sphere, cone and pyramid.	*	*		
16. State and apply theorem of Pappus or Gultinus to volumes of solids of revolution.	*	*		
17. Calculate volumes of frustum of cone and pyramid.	*	*		
18. State and apply ratio of volume of similar solids.	*	*		
19. Calculate volumes of irregular solids by Simpson's rules.	*	*		

	A	B	C	D
F. Trigonometry.				
1. Define right, acute, obtuse and reflex angles.				*
2. Define supplementary angles.				*
3. State relations between angles standing on circle's chords.			*	*
4. Bisect the angles of a triangle with inscribed circle.			*	*
5. Bisect the sides of a triangle with curcumscribed circle.			*	*
6. Solve similar triangles.			*	*
7. Define the basic trigonometric ratios (sine, cosine, tangent) of an angle θ for any right-angled triangle.			*	*
8. Define the reciprocals of the basic trigonometric ratios.		*	*	*
9. Read trigonometric tables.		*	*	*
10. Evaluate functions $\sin\theta$, $\cos\theta$, $\tan\theta$, where $0° < \theta < 360°$.	*	*	*	
11. Represent graphically in cartesian axes, $\sin\theta$, $\cos\theta$ and $\tan\theta$.	*	*	*	
12. Prove the theorem of Pythagoras.	*	*	*	
13. Establish the relation between trigonometric ratios.	*	*	*	
14. Define trigonometric identities.	*	*	*	
15. Prove simple trigonometric identities.	*	*		
16. State the sine and cosine rules.	*	*	*	
17. Apply sine and cosine rules to solution of triangles.	*	*	*	
18. Define inverse trigonometric functions.	*			
19. Solve simple trigonometric equations in range $0° < \theta < 360°$.	*	*		
20. Solve quadratic equations in one trigonometric variable.	*			
21. State general solution for a trigonometric equation.	*			
22. State compound angle identities.	*	*		
23. Solve equations involving double angle formulae.	*	*		
24. Convert sums and differences to products.	*			
25. Convert products to sums and differences.	*			
26. State power series expansions for $\sin\theta$ and $\cos\theta$.	*	*		

		A	B	C	D
G.	Complex Numbers.				
1.	Define a complex number.		*	*	
2.	Apply basic operations (addition, subtraction, multiplication and division) to complex numbers.	*	*	*	
3.	State the conditions for two complex numbers to be equal.		*	*	
4.	Define Argand Diagram.		*	*	
5.	Plot complex numbers on an Argand Diagram.	*	*	*	
6.	Convert polar form to cartecian form and vice-versa.	*	*		
7.	Multiply and divide complex numbers in polar form.	*	*		
8.	State De Moivre's theorem.		*		
9.	Find roots and powers using De Moivre's theorem.	*	*		
10.	State exponential form of a complex number.	*			
H.	Calculus.				
a.	Differentiation.				
1.	Explain the purpose of differentiation.	*	*		
2.	Determine the gradient at any point of a curve.	*	*		
3.	Determine differential coefficient of a function.	*	*		
4.	Differentiate a sum.	*	*		
5.	Differentiate trigonometric functions.	*	*		
6.	Differentiate logarithmic and exponential functions.	*	*		
7.	State and apply the rules for differentiation of product, quotient and function of a function.	*	*		
8.	Differentiate implicit relation (1st derivative).	*			
9.	Introduce logs to simplify differentiation.		*		
10.	State and apply succesive differentiation.	*	*		
11.	Apply differentiation to determine gradients and rates of change.	*	*		
12.	Apply differentiation to determine maxima and minima.	*	*		
13.	Apply differentiation to calculate small changes for functions of one variable.	*	*		
14.	State partial differentiation.	*	*		

	A	B
b. Integration.		
15. Explain the purpose of integration.	*	*
16. Explain integration process.	*	*
17. Determine the constant of integration.	*	*
18. Determine and apply integration of functioning involving powers of X.	*	*
19. Integrate trigonometric functions.	*	*
20. Integrate exponential functions.	*	*
21. Define definite integral.	*	*
22. Apply integration to the calculation of areas.	*	*
23. Calculate mean square value by integration.	*	*
24. Calculate volumes of revolution by integration.	*	*
25. Determine centres of gravity by integration.	*	*
c. Differential equations.		
27. Define a differential equation.	*	*
28. Determine general and particular solutions for a differential equation.	*	*
29. Solve first and second order differential equations.	*	*

CHAPTER II

THERMODYNAMICS

List of Topics:

A. Definitions.

B. Heat Transfer.

C. Gases.

D. Steam.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Definitions.				
1. Define and state the units of the terms mass, weight, work, power, energy, pressure, gauge pressure, absolute pressure, vacuum, volume and specific volume.		*	*	*
2. Solve problems involving the units of the above terms.		*	*	*
3. Explain the concepts of heat and specific heat of solids liquids and gases.		*	*	*
4. List methods for measurement of heat.			*	*
5. Define heat, specific heat, sensible heat, latent heat, total heat and temperature.			*	*
6. Convert temperature measurements of one scale to measurements of another scale.			*	*
B. Heat Transfer.				
1. Define heat transfer, heat transfer coefficient and overall heat transfer coefficient.	*	*	*	*
2. Explain the following forms of heat transfer: (a) conduction; (b) convention and (c) radiation.	*	*	*	
3. Illustrate heat transfer through composite wall and through cylindrical wall.	*	*	*	

		A	B	C	D
4.	Discuss heat transfer between fluids, through dividing wall.	*	*	*	
5.	Describe boundary layer surface effect.	*	*	*	
6.	Explain overall heat transfer coefficient.	*	*	*	
7.	Solve problems involving composite flat plates and surface effects.	*	*	*	
C.	Gases.				
1.	Illustrate Boyle's and Charle's laws for perfect gases.	*	*	*	*
2.	State the combination of Boyle's and Charle's laws.	*	*		
3.	Explain how the characteristic equation of perfect gases (gas constant) is derived.	*	*	*	*
4.	State the Avogadro's law and explain the universal gas constant.	*	*		
5.	State and apply Dalton's law of partial pressures.	*			
6.	State the first law of thermodynamics (Joule's law).	*	*	*	
7.	Explain the relationship between specific heat at constant volume and specific heat at constant pressure of a gas.	*	*	*	*
8.	Apply the Boyle's, Charle's, Joule's laws and gas constant, in solving problems.	*	*	*	
9.	State the conditions necessary for a process to be classified as reversible.	*	*	*	
10.	Explain the following processes, determining the transfered work: (a) constant volume; (b) constant pressure; (c) constant temperature; (d) adiabatic and (e) polytropic.	*	*	*	
11.	State the laws of expansion and compression.	*	*	*	
12.	Determine graphically the exponent (n) of polytropic expansion process.	*			
13.	Determine graphically the curve $P \cdot V = C$ (isothermal) for gases.	*	*		

	A	B	C	D
14. State the relationships: temperature - volume and temperature - pressure when $pv^n = c$.	*	*	*	
15. State the second law of thermodynamics.	*			
16. Describe the Carnot cycle and define Carnot efficiency.	*	*	*	
17. Calculate Carnot efficiency and determine the conditions for maximum efficiency.	*	*	*	
18. Describe the reverse Carnot cycle.	*			
19. Draw the P.V.diagram and describe Otto (constant volume) cycle.	*	*	*	
20. Calculate thermal efficiency of Otto cycle.	*	*	*	
21. Compare real and ideal Otto cycles.	*	*		
22. Compare the real four-stroke Diesel cycle to the ideal Diesel (constant pressure) cycle.	*	*		
23. State the thermal efficiency of the ideal Diesel cycle.	*	*		
24. Describe the dual combustion cycle.	*	*	*	

D. Steam.

1. Outline the steam evaporation process.	*	*	*	*
2. State: (a) the characteristics; (b) properties and calculate the internal energy of water and steam (saturated, superheated).	*	*	*	
3. Identify the critical point characteristics.	*	*	*	
4. Explain : (a) enthalpy; (b) specific enthalpy and (c) total enthalpy of steam.	*	*	*	
5. Describe the steam tables and apply such tables in solving problems for steam.	*	*	*	
6. Explain entropy of water and steam.	*	*	*	
7. Solve problems on steam enthalpy.	*	*	*	
8. Describe the following steam processes and state their effects: (a) constant pressure; (b) constant volume; (c) constant temperature; (d) constant entropy; (e) adiabatic and (f) throttling.	*	*	*	
9. Solve problems on nozzles involving pressure, volume, temperature, dryness fraction, cross sectional area and mass flow rate.	*	*	*	

	A	B	C	D
10. Describe the Mollier diagram (H - S) and plot state points and process lines.	*	*	*	
11. Solve problems on steam processes using the Mollier diagram.	*	*	*	
12. Describe the Carnot and Rankine cycles on P - V and T - S diagrams.	*	*		
13. Compare efficiencies of Carnot and Rankine cycles.	*	*		
14. Illustrate on P - V and T - S diagrams, the modified Rankine cycle for (a) superheated vapour entering turbine and (b) reheated vapour between stages.	*	*		
15. Explain specific steam consumption.	*	*	*	
16. Solve problems related to Carnot, Rankine and modified Rankine cycles.	*	*		
17. Outline the effect of regenerative feed heating on the plant thermal efficiency and specific steam consumption.	*	*	*	
18. Illustrate on T - S diagrams regenerative feed heating cycles.	*	*	*	
19. Solve problems relating to regenerative feed heating cycles, thermal efficiency and specific steam consumption.	*	*	*	

CHAPTER III

MECHANICS

List of Topics:

A. Statics.

B. Strength of Materials.

C. Dynamics.

D. Friction.

E. Hydraulics.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Statics.				
1. Define the following: (a) vector and scalar quantities; (b) universal gravitational constant; (c) coplanar and non coplanar forces and (d) moments and couples.			*	*
2. Describe stable, unstable and neutral equilibrium.			*	*
3. State the conditions of equilibrium for coplanar force system.			*	*
4. Determine the centroid and centre of gravity of regular surfaces and bodies.	*	*	*	
5. Solve problems involving second moments of area.	*			
6. Explain theorem of parallel axes and polar second moments.	*	*		
7. Solve problems involving: (a) vectors; (b) coplanar and non coplanar forces and (c) moments.	*	*	*	*
8. Define velocity ratio and mechanical advantage and determine velocity ratio for the following simple lifting machines: (a) rope pulley block; (b) wheel and axle; (c) screw and hydraulic jacks; (d) worm and worm wheels and (e) single and double purchase crab winch.	*	*	*	*
B. Strength of Materials.				
1. Define strength of materials.			*	*

	A	B	C	D
2. Define and explain the following:	*	*	*	*
(a) tensile, compressive and shear forces;			*	*
(b) stress and forms of stress;		*	*	*
(c) working stress and factor of safety;	*	*	*	
(d) strain and forms of strain;			*	*
(e) elasticity, modulus of elasticity and Hook's law, and	*	*	*	
(f) limit of proportionality, elastic limit, yield point.	*	*	*	
3. Solve problems involving stress, strain and modulus of elasticity.	*	*		
4. Calculate stress in compound bars.	*	*		
5. Define equivalent modulus of elasticity of compound bars.	*	*		
6. Define stresses due to restricted thermal expansion.	*	*	*	*
7. Explain stresses due to thermal expansion in compound bars.	*			
8. Solve problems on stresses due to thermal and external applied forces.	*	*		
9. Define and calculate elastic strain energy.	*			
10. Explain the effects of suddenly applied and shock load on springs and on solid bars.	*	*		
11. Define shear force and bending moment.		*	*	*
12. Calculate shear force and bending moment at any point along a beam and solve related problems.	*	*	*	
13. Prepare graphs of shear force and bending moments against length of beam.		*	*	*
14. Calculate maximum bending moment.	*	*		
15. Define the neutral axis of a beam subject to the bending moments and derive the fundamental bending equation.		*	*	*
16. Define modulus of section.	*	*		
17. Define deflection of beams and state maximum deflection.	*			
18. State expressions for combined bending and direct stress.	*	*		
19. Solve problems involving: (a) direct stresses due to bending actions and (b) transverse deflections on beams and cantilever.	*	*	*	
20. Define torsion of shafts and state the fundamental torsion principles.	*	*	*	*

	A	B	C	D
14. Define work, power and energy and express the relations between them.			*	*
15. Solve problems involving the dynamics of spring controlled governors and the stiffness of controlling springs.	*	*		
16. Solve problems involving work done by constant and variable forces.	*	*		
17. Solve problems involving developed power for linear and angular motion.	*	*		
18. Define potential energy, kinetic energy, kinetic energy of translation and kinetic energy of rotation and solve problems on them.	*	*	*	
19. Define fluctuation of speed and energy and solve problems on effects of flywheels or torque variation.	*	*		
20. Describe simple harmonic motion in terms of acceleration and displacement.	*	*		
21. Prove that the linear oscillation of a mass attached to a spring is simple harmonic motion.	*	*	*	
22. Solve problems involving the simple harmonic motion of mass/spring system and rotor/shaft system.	*	*		

D. Friction.

1. Define static friction and sliding friction.			*	*
2. State the laws of sliding friction.		*	*	*
3. Define coefficient of friction and state the relationship between friction and coefficient of friction.		*	*	*
4. Describe friction on inclined plane.	*	*	*	
5. Solve problems involving friction of masses on horizontal and inclined planes and problems involving friction work.	*	*		
6. Explain thread friction and state equations for mechanical efficiency of square and vee threads.	*	*		
7. Describe the radial and thrust bearing types on board a ship.	*	*	*	*
8. Solve problems involving: (a) friction on dry journal bearing caused by transverse load and (b) torque on a lubricated journal bearing assuming journal and bearing to be concentric.	*			

	A	B	C	D
E. Hydraulics.				
1. Define density, relative density, mass flow and volume flow and state their units.			*	*
2. Explain the Archimedes principle and solve problems on floating bodies.		*	*	*
3. Explain the factors affecting the pressure at a depth in a fluid.			*	*
4. Solve problems involving forces on submerged areas of rectangular and horizontal shape.	*	*		
5. Calculate the forces and the centre of pressure in tank sides and bulkheads for non mixing liquids and solve problems relating to this.	*	*	*	
6. Explain the function of U-type manometer.			*	*
7. Explain the Pascal's principle and describe applications on ships.		*	*	*
8. Calculate the flow of a liquid (a) through a pipe; (b) through a valve and (c) through an orifice.	*	*	*	
9. Explain the Bernoulli's equation and describe the Venturi's meter.	*	*	*	
10. Define and explain discharge coefficient.		*	*	*
11. State the laws of friction relating to flow of liquid through pipes and calculate the loss of head due friction.	*	*	*	
12. Calculate the impact of water jet on a stationary or moving perpendicular plate.	*	*	*	
13. Solve problems relating to 8, 9, 11 and 12 above.	*	*		
14. Explain the functions of volute chamber and diffuser ring and state inlet and outlet velocity diagrams in a centrifugal pump.	*	*		
15. Solve problems for centrifugal pumps involving the calculation of the following: (a) manometric and associated heads; (b) blade angles; (c) fluid velocities and manometric efficiency.	*			
16. Name hydraulic systems used on board ships and describe hydraulic pumps, hydraulic motors and control valves.		*	*	*

PROPERTIES AND TECHNOLOGY OF MATERIALS

List of Topics:

A. Manufacturing Metallurgy.

B. Properties and Tests.

C. Treatment of Materials.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Manufacturing Metallurgy.				
1. Classify the furnaces used for melting of metals.			*	*
2. Describe a tower furnace for melting aluminium.		*		
3. Outline the processes for manufacturing: (a) cast iron and (b) steel.	*	*		
4. Describe the steel ingot and state its main defects.	*	*		
5. Outline the processes for casting (a) brasses; (b) phosphor bronzes; (c) aluminium bronzes and state the main defects of their ingots.	*	*		
6. Describe the moulds and state the moulding materials in sand casting process.	*	*		
7. State methods used to control solidification during casting.	*			
8. Explain the defects of sand casting and die casting methods.	*	*		
9. Outline the most common casting methods.	*			
10. Explain the metalurgical principles of forging.		*	*	
11. Explain the crystalline structure of metals.			*	*
12. Outline methods for manufacturing (a) tubes and (b) wires.	*	*		
B. Properties and Tests.				
1. State the physical, mechanical and chemical properties of materials.	*	*	*	*

	A	B	C	D
2. Outline the following tests used to evaluate properties of materials: (a) Tensile strength test; (b) Hardness tests; (c) Impact test and (d) Non destructive tests.	*	*	*	*
3. State the most common impurities in steel and their effects on the properties of the material.			*	*
4. Explain the mechanical deformation of metals and state the methods used for recovery.	*	*	*	
5. Describe the main forms or metal fructure.		*	*	*
6. Describe the mechanism of fatique and state methods for improving the materials.	*	*	*	
7. Define creep and creep resistance.	*	*		
8. Describe the properties and list the uses and composition of cast iron.		*	*	*
9. Discuss the effects of the following: (a) nickel; (b) chromium; (c) vanadium and (d) copper, on the properties of cast iron.		*	*	
10. Describe the properties and state the composition of plain carbon steels.		*	*	*
11. Describe the properties and give the composition of the following alloy steels: (a) chromium steels; (b) nickel-chromium steels and (c) steels containing one or more of the following elements: molybdenum, vanadium, maganese, copper.	*	*	*	*
12. State the properties and list the uses and composition of the following copper base alloys.	*	*	*	*
(a) brasses;	*	*	*	*
(b) bronzes and	*	*	*	*
(c) nickel silver.	*	*		
13. State the properties and list the uses of aluminium.		*	*	*
14. State the properties and list the uses and compostion of wrough and cast aluminium alloys.	*	*	*	
15. State the properties and list the uses of the following alloys:	*	*	*	*
(a) magnesium - base alloys;	*	*	*	
(b) zinc - base die - casting alloys;	*	*	*	

	A	B	C	D
(c) nickel - base corrosion resistance alloys;	*	*		
(d) copper - base bearing alloys and	*	*	*	*
(e) aluminium - tin bearing alloys.	*	*	*	*
16. Describe the requirements of a bearing metal.	*	*	*	*
17. List the properties of standard tool materials.				*
18. List types and uses of metal cutting fluids.				*
19. State the properties of uranium and its isotopes.	*	*	*	
20. State the properties of ceramics and their applications.	*	*	*	*
21. List the main polymer materials.	*	*	*	*
22. State the properties of plastics and give their applications in ships.	*	*	*	*
23. State the properties of rubber.	*	*	*	*

C. Treatment of Materials.

1. Outline the following steel heat - treatment processes: (a) annealing; (b) normalizing; (c) hardening and (d) tempering.	*	*	*	
2. Outline the main steel surface hardening processes:	*	*	*	
(a) case hardening;	*	*	*	
(b) carburizing;	*	*	*	
(c) gas carburising;	*	*	*	
(d) nidring;	*	*	*	
(e) localised heat treatment.	*	*	*	
3. Explain the principles of quenching and state the main requirements of quenching oils.		*	*	*
4. Describe methods used to anneal (a) aluminium and (b) copper.	*	*	*	
5. Describe the main metal surface treatment methods and outline the surface preparation for treatment.	*	*	*	*
6. Outline the following metal joining methods:	*	*	*	*
(a) oxy - acetylene pressure welding;	*	*	*	
(b) electrical - resistance welding;	*	*	*	
(c)soldering;			*	*
(d) brasing;			*	*

	A	B	C	D
(e) gas - welding;			*	*
(f) metallic arc - welding;			*	*
(g) friction welding;	*			
(h) cold - pressure welding;	*			
(i) explossive welding;	*			
(j) ultra - sonic welding;	*	*		
(k) arc - welding methods;	*	*	*	*
(l) electron - beam welding;	*			
(m) lazer welding.	*			
7. State the main welding defects and methods.	*	*	*	*
8. Outline methods used for inspection and tests of welds.	*	*	*	
9. Outline the mechanism of the forms of corrosion.	*	*	*	*
10. Outline the most common methods used for prevention of marine corrosion.	*	*	*	*

CHAPTER V

FUELS AND LUBRICANTS

List of Topics:

A. Fuels.

B. Combustion Process.

C. Lubricants.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Fuels.				
1. Identify the solid,liquid and gaseous fuels used aboard ship.			*	*
2. Outline the theories of the origin of crude oil.			*	*
3. Describe the chemical composition of the paraffinic and naphthenic base crude oil.	*	*	*	
4. Outline processes of fractional distillation, cracking and reforming of crude oil.		*	*	*
5. List the main crude oil products.			*	*
6. State the classification of fuel oils according to their flamability.	*	*	*	
7. State the data obtained out from fuel oil analyses.	*	*	*	*
8. Define and/or describe the following: (a) relative density; (b) specific gravity measurement scales; (c) viscosity; (d) fluid point;(e) pour point; (f) solidifying point; (g) flash point; (h) fire point; (i) auto-ignition temperature and (j) distillation characteristics.	*	*	*	
9. Outline methods for estimating: (a) specific gravity; (b) viscosity; (c) flash point and (d) diesel index.	*			
10. State the physical and chemical properties of the following fuel oils: (a) petrol; (b) kerozene; (c) gas oil; (d) diesel oil and (e) heavy fuel oil.	*	*	*	*
11. List the data to be considered when ordering or receiving fuels.	*	*	*	

	A	B	C	D
12. Classify the heavy fuel oil and state average values for density, flash point, heat of combustion, viscosity, sulphur and ash contents.	*	*		
13. State the effects of mixing different types of fuels (a) for short period and (b) for long period.	*	*	*	
14. State the effects of the presence of the folowing in the fuel oils: (a) sulphur; (b) vanadium; (c) water; (d) ash.	*	*		
15. Discuss the treatment of fuels onboard ship.	*	*	*	
16. Describe cetane and octane numbers and calculate diesel index.		*		
B. Combustion Process.				
1. Explain the principle of combustion of solid, liquid and gaseous fuels.		*	*	*
2. Calculate the fuel/air ratio required for proper combustion. Explain 'excess air' coefficient.	*	*	*	
3. Analyze the combustion products and solve problems involving flue gas analysis.	*	*	*	
4. Calculate mass and/or volume of waste gas products.	*	*		
5. State the requirements of proper combustion and state factors affecting proper combustion.	*	*	*	*
6. State combustion pressures and temperatures in: (a) boilers; (b) diesel engines and (c) gas turbines.	*	*	*	*
7. Explain why very high / very low combustion temperatures are not desirable.	*	*	*	*
C. Lubricants.				
1. Explain the following processes: (a) fluid lubrication; (b) boundary lubrication and (c) extreme pressure lubrication.	*	*		
2. State the properties of lubricants according to their origin.		*	*	*
3. State the data obtained out from lub oil analysis.		*	*	*

		A	B	C	D
4.	Classify lubricating oils according to their viscosity and define viscosity index.	*	*	*	
5.	Define: (a) Neutralization Number; (b) Total Acid Number (TAN); (c) Weak Acid Number (WAN); (d) Strong Acid Number (SAN) and Total Base Number (TBN) and state their desired values and their effect on the quality of oils.	*	*	*	
6.	Define emulsification and explain demulsification number.	*	*	*	
7.	State the effect of the following elements in lubricating oil service: (a) water content; (b) cediment content; (c) coking residue and (d) sulphate ash.	*	*	*	
8.	List the lubricating oil additives and state the functions of each one.	*	*	*	*
9.	Discuss greases (origin, mixtures, properties, applications).	*	*	*	*
10.	Describe the treatment of lubricants onboard ships.	*	*	*	
11.	Describe the procedure for selecting samples of oil.	*	*	*	
12.	Outline the test carried out onboard ship to estimate the condition of oils.	*	*	*	
13.	State the data to be considered when ordering or receiving lubricants.	*	*	*	
14.	State the required properties for the following oils: (a)diesel engine lubricating oil; (b) steam turbine lubricating oil; (c) lubricating oil for turbo-chargers and (d) cylinder (lubricating) oil.	*	*	*	

BOILERS

List of Topics:

A. Description.

B. Construction.

C. Operation and maintenance.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Description.				
1. Classify the marine boilers including steam generators and outline the characteristics of each type.			*	*
2. Sketch and describe the following boiler types: (a) fire-tube; (b) water-tube; (c) superheat boilers.	*	*	*	*
3. Produce sketches showing the main parts of boilers.	*	*	*	*
4. Name the internal and external fittings of a boiler and explain the function of each fitting.		*	*	*
5. Describe the construction and state the function of the following boiler mountings listing advantages and disadvantages for them: (a) superheaters; (b) de-superheaters; (c) economizers; (d) air heaters; (e) soot blowers.		*	*	*
6. Illustrate construction details and explain the principle of operation of the following: (a)fuel burners; (b) gas analysers; (c) CO2 recorders; (d) flow meters.	*	*	*	
7. Describe the features of the following boiler systems: (a) combustion air; (b) oil burning; (c) feed water; (d) steam.	*	*	*	*
8. State the controls used in the boiler systems listed in question 7 above and explain the function of each control.	*	*	*	
9. Define " natural draught ", " forced draught " " induced draught " and " balanced draught ".			*	*
10. Describe the process by which a residual fuel is burnt in a boiler furnace. Identify the dangers involved in heating fuel oil.		*	*	*

	A	B	C	D
11. Explain what determines the location of superheater in a water tube boiler and how it is protected. Describe how temperature is contrlolled. Discuss metals used in superheater tubes.	*	*	*	
12. Explain steam and water circulation. Describe two general types of water circulation found in water-tube boilers.		*	*	*
13. Sketch and name the parts and fittings of any high pressure steam and water cycle. Give pressures and temperatures.	*	*	*	*
14. Describe,in brief, the machinery usually found in a boiler room.		*	*	*
15. Describe, with the aid of line diagrams, a water and steam cycle employing nuclear reactor for generating steam. Explain in detail how the feed water is circulated through the reactor.	*	*	*	
16. Explain, with the aid of sketches, the principle of operation of an exhaust gas boiler.	*	*	*	
17. Sketch and describe a composite boiler suitable for producing low pressure steam for auxiliary purposes.	*	*	*	
B. Design and Construction.				
1. Outline a boiler design criteria.	*	*	*	
2. Calculate fuel consumption and heated surface and volume for the following spaces: (a) combustion chamber; (b) water drum; (c) steam drum.	*	*		
3. State the losses of a boiler and explain the methods employed to increase boiler efficiency.	*			
4. Outline a boiler construction principles.	*	*		
5. List the materials used for the construction of each one of the main parts of a boiler.	*	*	*	*
6. Describe the methods of tube attached in fire-tube and water-tube boilers.	*	*	*	*

		A	B	C	D
7.	List the boiler parts which are subjected by one or more of the following stresses: tensile, compressive,shearing, bending and torsional.	*	*	*	*
8.	State the losses of a boiler and explain the methods used to increase boiler efficiency.	*	*	*	*

C. Operation and Maintenance.

1.	Outline the procedures for starting, warming, raising steam, communicating (in case of two boilers), operating and cutting out of service a high pressure boiler.	*	*	*	*
2.	Describe the duties of the watch-keeper in a boiler room.		*	*	*
3.	State the actions which should be taken in the following cases: (a) sea water in boiler; (b)steam leaks; (c) water level gauge not functioning; (d) tubes leaking; (e) fires go out of a boiler.	*	*	*	*
4.	State the precautions which should be taken in the following cases: (a) to minimize the possibility of soot fires in economizer;(b) when using steam soot blowers; (c) when blowing down; (d) when working on low pressure boiler gauge classes.	*	*	*	*
5.	State causes of the following failures:(a) superheater temperature rising under constant load condition; (b) corrosion of fire sides; (c) slag accumulations; (d) formation of coke in the furnace; (e) priming; (f) boiler vibration.	*	*	*	*
6.	Give the colours which indicate non efficient combustions. State reasons for poor combustion.	*	*	*	
7.	Describe the effects of boiler corrosion and outline the methods used to eliminate it.	*	*	*	
8.	State when surface and when bottom blow down should be used.			*	*
9.	State the sources of sludge, scale and corrosion in boilers.		*	*	*

	A	B	C	D
10. Illustrate the purpose of boiler water treatment.		*	*	*
11. Outline the most common boiler water tests.	*	*	*	*
12. Discuss the use of chemicals in boiler water treatment process.	*	*	*	*
13. Describe internal and external boiler cleaning.	*	*	*	*
14. State preparations for the inspection and hydrostatic test of a boiler.	*	*	*	
15. Describe procedures for opening and closing up a boiler. State the precautions which should be taken.	*	*	*	*
16. State boiler tests and surveys required by classification societies.	*	*	*	
17. Outline the maintenance which should be carried out in laid up boiler.	*	*	*	
18. Identify causes of fire in a boiler room. State precautions to be taken to eleminate fire hazards. Describe the action which should be followed in case of fire.	*	*	*	*

CHAPTER VII

STEAM TURBINES

List of Topics:

A. Basic Theory.

B. Construction.

C. Systems and Control.

D. Operation.

E. Maintenance.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Basic Theory.				
1. State the principle of operation of a steam turbine.			*	*
2. State the characteristics of (a) an impulse and (b) a reaction turbine.		*	*	*
3. Discuss, with the aid of sketches, the action of a stream of steam as it passes (a) through the moving blades of an impulse turbine and (b) through the moving blades of a reaction turbine. Calculate forces on blades.	*	*	*	
4. Describe, with the aid of sketches, (a) a convergent nozzle and (b) a convergent-divergent nozzle. Explain the behaviour of the steam as it passes through each type. Calculate the velocity of the steam leaving the nozzle.	*	*	*	
5. Describe, with the aid of suitable diagrams, the way in which pressure and velocity vary in the following turbines: (a) simple impulse; (b) pressure-compounded; (c) velocity-compounded; (d) pressure-velocity-compounded; (e) reaction; (f) Rateau.	*	*	*	
6. Discuss the use of the various turbine types in marine applications.		*	*	*
7. Calculate Rankine efficiency and real efficiency of a steam turbine.	*	*		

	A	B	C	D
8. Explain how the total expansion of steam in a turbine is estimated and how the quantity of steam consumed by a turbine is determined.	*	*	*	
9. List the main losses of a turbine and describe how its output is estimated.	*	*	*	
10. Discuss steam bleeding. State advantages and disadvantages of bleeding.	*	*	*	

B. Construction.

1. Describe, with the aid of sketches, the construction details of the following: (a) H.P. turbine (rotor and casing); (b) L.P. turbine (rotor and casing including astern turbine); (c) H.P. and L.P. turbine glands. Name the parts shown in the sketches and state the function of each part.	*	*	*	*
2. Sketch and describe a built up turbine rotor and discuss its application for marine use.			*	*
3. State briefly how a turbine rotor is manufactured, give the materials used in its construction and state any test to which is subjected.	*	*	*	
4. Give the materials used in the construction of a turbine casing. Explain how expansion of a turbine casing is accommodated.		*	*	*
5. Sketch and describe a typical shaft gland giving materials and clearances.	*	*	*	*
6. Sketch and describe turbine blading. State the difference between impulse and reaction blading. Discuss the stresses to which turbine blades may be subject and mention some defects.	*	*	*	
7. Describe the methods for fixing blades to a turbine rotor. Explain why shrouding and lacing wires are frequently used on turbine blades. Show in sketches how they may be fitted.	*	*	*	*
8. Show how casing blades may be fitted.	*	*	*	

	A	B	C	D
9. State the properties required for turbine blading materials.	*	*	*	*
10. Describe, with the aid of sketches, the various types of steam seals used in high and low pressure turbines.	*	*	*	
11. Sketch and describe a typical arrangement of dumming piston and dumming cylinder.		*	*	
12. Sketch and describe a bearing for a turbine rotor shaft. State the materials used in the construction.		*	*	
13. Sketch and describe a turbine rotor thrust block. Explain how the block is lubricated and state the materials used. Briefly explain how oil clearances can be checked.	*	*	*	
14. Describe, with the aid of sketches, flexible couplings suitable for a main turbine rotor/pinion application.	*	*	*	
15. Sketch and describe the gearing systems which are commonly used in steam power plants.		*	*	*
16. State the types of tooth employed in marine reduction gears. Explain how load is shared and transmitted between teeth.	*	*	*	
17. State materials used for marine gearing construction. List the properties required for the marine gearing materials.	*	*	*	*
18. Describe, with the aid of diagrams, the operation of a steam - electric power plant.	*	*	*	*

C. Systems and Control.

1. Describe, with the aid of line diagrams, the following turbine lubricating oil systems: (a) gravity; (b) force - feed. State advantages and disadvantages of each system.	*	*	*	*
2. Discuss the properties required for a turbine lubricating oil.	*	*	*	*
3. Sketch and describe a turbine drain system and explain why it is necessary to have such a system. State the purpose of gland exhaust condenser.	*	*	*	*

	A	B	C	D
4. Describe the alarm or signals which are installed on the alarm panel of a steam turbine unit.	*	*	*	
5. Describe in detail the manual controls of a steam turbine.	*	*	*	
6. Describe in detail the following automatic controls of a turbine: (a) speed - regulating governor; (b) speed - limiting governor; (c) overspeed trip; (d) low oil-pressure trip; (e) excess back pressure protective device.	*	*	*	*
7. Explain how the admission of steam to a steam turbine is controlled.	*	*	*	*

D. Operation.

1. Describe how a turbine is prepared for operation.	*	*	*	*
2. Explain the reasons for warming up a steam turbine plant prior to departure. Describe in detail a procedure for warming up a turbine plant from cold. What treatment should be given to the reduction gear when warming up the main turbine;	*	*	*	*
3. List the points which should be given particular attention during manoeuvering and full speed conditions.	*	*	*	*
4. Describe the attention which should be given to the main turbine when in port.	*	*	*	
5. State the care which should be given to the main turbine, if it is to be left idle for an indefinite period.	*	*	*	
6. State the provisions which should be made for operating either the H.P or L.P. turbine independently in order to meet an emergency.	*	*	*	
7. Explain how a main or an auxiliary turbine is shut down in case of failure.	*	*	*	
8. State precautions which should be taken in the use of nozzles of the turbine when operating at high or low speed.	*	*	*	*

	A	B	C	D
9. Explain the following terms when applied to turbines operation: (a) all round admission; (b) overload; (c) partial admission; (d) nozzle control; (e) throttling; (f) sequential control.	*	*	*	
10. State the points of cautions which should be observed by an engineer in charge of a geared turbine in order to ensure the life and good condition of the main reduction gear.	*	*	*	*
11. State the duties of the engineer officer in charge of the watch in the engine room of a ship powered by steam turbines.	*	*	*	*

E. Maintenance.

1. State the requirements as to maintenance and operation in order to keep proper vacuum in a marine steam turbine installation.	*	*	*	
2. Name causes which may make a rotating part appear to be in dynamic unbalance, when the part actually is in acceptable balance.	*	*		
3. State the main lub oil system failures.	*	*	*	*
4. State causes of vibration and noise in turbines. Describe action to be taken.	*	*	*	
5. State causes of turbine blading erosion. Explain how erosion problems may be dealt with.	*	*	*	
6. Describe how a reduction gear should be cleaned and how it's oil should be replaced.	*	*	*	*
7. Explain, with suitable sketches, how rotor axial clearances may be taken when turbine rotor is stopped and when running.	*	*	*	
8. Explain briefly how balancing of turbine rotor is carried out. State why balancing is very important for turbine rotor.	*	*		

9. Describe how a turbine is opened up for inspection. Explain how the upper casing is supported. List precautions to be taken when making an inspection of the interior of a turbine and before and after reassembling the turbine. *

10. Explain why turbines are inspected periodically. State some of turbines inspections. *

CHAPTER VIII

MARINE DIESEL ENGINES

List of Topics:

A. Cycles and Basic Principles.

B. Construction.

C. Systems.

D. Operation and Maintenance.

E. Calculations.

The candidate is expected to be able to perform the following:

		Engineer Class		
	A	B	C	D
A. Cycles and Basic Principles.				
1. Define and explain the following operations: (a) isothermal; (b) adiabatic; (c) polytropic.			*	*
2. Define efficiency and state factors affecting the following efficiencies of a diesel engine: (a) volumetric; (b) scavenge; (c) thermal; (d) indicating; (e) mechanical; (f) real.	*	*	*	
3. Illustrate on P.V. diagrams the following ideal gas cycles and explain factors affecting their efficiency: (a) Otto; (b) Joule; (c) Diesel; (d) Dual; (e) Carnot.	*	*	*	
4. Illustrate on P.V. diagrams the actual cycles for 2 - stroke and 4 - stroke diesel and petrol engines. State pressures and temperatures at salient points.	*	*	*	*
5. Compare: (a) ideal to actual Diesel cycles; (b) 2 - stroke diesel to 4 - stroke diesel engine. State advantages and disadvantages of the above cycles.	*	*	*	
6. Explain the following and state factors affecting their values: (a) specific fuel consumption; (b) compression ratio; (c) free air ratio. Give their approximate values for low and medium speed engines.		*	*	*
7. State the relation between load and fuel consumption.	*	*	*	*
8. With the aid of line diagrams explain the heat balance for a diesel engine. Show in details the various losses and efficiencies.		*	*	*

		A	B	C	D
B.	Construction.				
1.	Classify the marine diesel engines according to: (a) revolutions; (b) cycles; (c) arrangement of cylinders; (d) method of scavenging.			*	*
2.	Describe, with the aid of sketches, the following types of internal combustion engines: (a) 2 - stroke crosshead diesel; (b) 4 - stroke diesel; (c) 4 - stroke petrol; (d) opposed piston; (e) double acting; (f) precombustion chamber.		*	*	*
3.	Describe in detail, with the aid of sketches the following diesel engine parts: (a) cylinder heads; (b) cylinders (liners and jackets); (c) pistons; (d) piston rings; (e) crossheads; (f) connecting rods; (g) crankshaft; (h) camshaft; (i) bearings (top, bottom, main and thrust); (j) bedplate and frame.	*	*	*	*
4.	Outline methods of construction for the engine parts listed in question 3 above and state the materials used in each case.	*	*	*	
5.	List the desired properties for diesel engine framework.	*	*		
6.	State the tests and treatment required to determine the properties and condition of materials used for crankshaft construction.				
7.	Determine the angles between the cranks of 2 - stroke and 4 - stroke diesel engines. Give reasons for the arrangement.			*	*
8.	Compare the main bearings of a slow speed diesel engine to the main bearings of a medium speed diesel engine, in terms of construction.	*	*	*	
9.	Explain the function of: (a) flywheel; (b) counterweights.			*	*
10.	Describe the power transmission from the crankshaft to the camshaft of a diesel engine. State the relation between crankshaft and camshaft revolutions in 2 - stroke and 4 - stroke engines.			*	*
11.	Describe, with the aid of sketches, the methods employed to attach a connecting rod to a piston, in trunk piston engines. State advantages and disadvantages for each method.		*	*	*

	A	B	C	D
12. Explain how inlet and exhaust valves are activated. Describe the various methods employed in 2 - stroke and 4 - stroke engines. List and describe the various parts and fittings involved in valve activation.			*	*
13. Explain the purpose of valve seat insert. State advantages and disadvantages of inserts.		*	*	*
14. State the advantages and disadvantages of the use of poppet exhaust valves in large 2 - stroke engines.	*	*	*	
15. Discuss the factors which govern the main piston speed in a diesel engine.	*	*		
16. State the differences between a piston used in crosshead type engines and a trunk type piston.		*	*	*
17. Where alloyed aluminium pistons are used discuss the following: (a) incendive sparking; (b) position of oil acraper rings; (c) piston and liner clearances; (d) piston lubrication and cooling.	*	*	*	
18. State values for the following clearances: (a) air inlet and exhaust valves tappets; (b) piston rings (axial, radial); (c) bearings.	*	*	*	
19. Describe how a cylinder liner of a 2 - stroke crosshead engine is secured and how expansion is allowed. Explain why cooling is necessary.		*	*	
20. Identify the various stresses exerted on the following engine parts of 2 - stroke and 4 - stroke diesel engines: (a) cylinder heads; (b) piston; (c) piston rings; (d) cylinder liners; (e) tie rods; (f) bearings; (g) crankshafts. Explain what aspects of design and maintenance assist in alleviating the above stresses.	*	*		
21. Solve problems involving stresses exerted on pistons, bearings and crankshaft of diesel engines.	*	*		
22. Describe and explain a shaft generator arrangement. State the advantages of such arrangement.	*	*		

		A	B	C	D
C.	**Systems.**				
a.	Fuel system.				
1.	Describe, with the aid of line diagrams, fuel systems suitable for: (a) a slow speed diesel engine; (b) a medium speed trunk piston engine. Show all fittings and equipment used and give pressures and temperatures before and after each unit.	*	*	*	*
2.	Explain how heavy fuel oil is automatically heated before burning in the cylinders of a diesel engine.		*	*	*
3.	Discuss the effect of the following in the diesel engine combustion process: (a) viscosity; (b) atomization; (c) penetration; (d) turbulence. Explain how their desired values could be obtained.	*	*	*	
4.	Sketch and describe a hydraulically operated fuel injector for a diesel engine. Explain how the pressure at which fuel is injected could be adjusted.		*	*	*
5.	Sketch a Bosch Jerk type fuel pump. Explain how the timing and quantity of the supplied fuel is regulated. Describe how the pump is adjusted. Explain how fuel injection is electronically controlled in new slow speed diesel engines.	*	*	*	
6.	Explain how speed governors and overspeed protection trip are connected to the fuel system.			*	*
7.	State the composition of heavy fuel oils. Explain how fuel oil is cleaned before burning in the engine.	*	*	*	
b.	Starting and reversing.				
8.	Describe the various methods used to start marine diesel engines.				*
9.	Describe, with the aid of a line diagram, an air starting system for a large crosshead type diesel engine. Show and name the necessary parts and fittings. Enumerate the safety devices fitted.	*	*	*	
10.	Make a line diagram of an air receiver for a large marine diesel engine. Enumerate all fittings installed explaining their purpose. State the capacity of the receiver.			*	*

	A	B	C	D
11. Explain, with the aid of sketches, the principle of operation of the following: (a) air control valve; (b) air automatic valve; (c) air distributor; (d) cylinder air start valve.		*	*	*
12. Describe, with the aid of line diagrams,the various systems which are used for reversing of a 2 - stroke crosshead type diesel engine.	*	*	*	
13. Discuss the following: (a) air starting period; (b) air starting overlap; (c) air starting speed; (d) lost of motion.		*	*	*
14. Describe in brief the air starting and reversing systems which are used in MAN - B&W and sulzer slow speed engines*		*		
15. Explain the various interlocking systems fitter in the air starting and reversing gears of slow speed diesel engines in order to prevent wrong manoeuvering actions.	*	*	*	
c. Exhaust and air inlet system.				
16. Discuss the following: (a) scavenging; (b) supercharging; (c) scavenge efficiency; (d) overlap in air inlet and axhaust valves; (e) constant pressure operation and pulse operation.		*	*	
17. Describe, with the aid of sketches, the methods of scavenging employed in large two stroke diesel engines. State advantages and disadvantages for each one. Name the most popular method, today.		*	*	*
18. Describe, with the aid of line diagrams, the gas exhaust and air inlet systems of a 2 - stroke crosshead type diesel engine fitted with turbo-charger. Give pressures and temperatures of exhaust gases and inlet air before and after main units.	*	*	*	*
19. Describe the configuration of the scavenge space of a 2 - stroke crosshead type diesel engine. Describe in detail the construction of the various fittings and state the purpose of each one.	*	*	*	
20. State advantages and disadvantages of turbo-charging. Explain arrangements made for manoeuvering in turbo-charged engines.		*	*	*

	A	B	C	D
21. Sketch and describe a turbo-charger suitable for use with large bore engines. Give materials used and describe bearing arrangements. Explain how bearings are lubricated. Give efficiencies for turbo-chargers.	*	*	*	
22. Sketch and describe air coolers for turbo-charged engines. Explain how cooling is controlled and state the effects of undercooling of air.	*	*	*	*
23. With regard to a 4 - stroke diesel engine explain why: (a) air inlet and exhaust valves open inwards; (b) some valves are cooled while others are not; (c) tapper clearances are necessary in valve operating gear. State the consequences of having clearances in (c) greater or less than recommended values.	*	*	*	
24. Describe the various types of exhaust silencers used in main marine diesel engines. State advantages and disadvantages for each type.		*	*	*
d. Cooling.				
25. State reasons for cooling of a diesel engine.			*	*
26. State advantages and disadvantages of fresh water, distilled water and lubrication oil when are used as cooling mediums. Describe the treatment required in order these mediums to be suitable for use in a diesel engines' cooling systems.		*	*	
27. Describe, with the aid of line diagrams, a cooling system for the pistons and jackets of a slow speed large diesel engine. Explain how expansion of the parts is accommodated without leakage.	*	*	*	
28. State the engine parts which are normally cooled and show in detail,with the aid of sketches, how cooling of each part is succeded.	*	*	*	
29. Describe, with the aid of line diagrams, cooling systems suitable for medium and high speed engines.		*	*	*
30. Describe the types of pumps and the types of coolers which are employed in diesel engines' cooling systems.		*	*	

	A	B	C	D
e. Lubrication.				
31. Describe, with the aid of line diagrams, lubricating oil systems suitable for the following engines: (a) slow speed main engine; (b) medium speed main engine; (c) auxiliary engine. State pressures and temperatures before and after the main units of the systems.	*	*	*	*
32. List the parts of a diesel engine which are lubricated and explain why lubrication is necessary in each one. Describe, with the aid of sketches,how the various parts are lubricated.	*	*	*	
33. State the desired properties of lubricants and list the most common lubricant additives stating their effects. Explain how lubricants are treated onboard ships.	*	*		
34. Describe the various systems employed for cylinder lubrication of crosshead type diesel engines. Show how cylinder oil is introduced and how is spread to the internal surface of the cylinders.	*	*	*	
35. State the main requirements for cylinder oils and explain the contribution of the oil in maintaining the condition of cylinder liners.	*	*	'	
36. Describe the types of pumps, types of filters and types of coolers which are employed in diesel engines, lubrication systems.		*	*	
f. Control.				
37. Explain how the speed of an engine is maintained within preset limits. State the roles of speed governor and overspeed protection system.		*	*	*
38. Explain, with the aid of sketches, the principle of operation of the most common governors which are used for marine diesel speed control.	*	*	*	
39. Describe how the main engine is controlled: (a) from the engine room; (b) from the engine control room; (c) from the bridge. Explain how the control is changed over from one system to another.	*	*	*	

	A	B	C	D
40. Sketch and describe methods for controlling temperatures and pressures in systems of an engine. With the aid of sketches, explain how alarm is given when temperatures or pressures exceed preset limits.	*	*		
8. Waste heat recovery systems.				
41. Describe, with the aid of sketches, the various waste heat recovery systems which have been employed to recover some of the waste energy in gases and cooling water. State the advantages and disadvantages assosiated with the installation, operation and maintenance of the systems.	*	*	*	
42. Describe the main types of boilers employed to utilize part of the exhaust gas heat.	*	*	*	*
D. Operation and Maintenance.				
1. Describe the preparation of the engine before starting (a) in normal weather and (b) during cold weather.	*	*	*	*
2. Outline the procedures for starting and stopping a diesel engine.	*	*	*	*
3. Enumerate as many reasons as possible, for the following engine failures: (a) failure to start; (b) failure to pick up fuel speed; (c) the engine stops without altering the setting in the control level; (d) the number of revolutions are not constant; (e) great differnce in exhaust temperatures between the various cylinders; (f) smoke exhaust (blue, black, white smoke).	*	*	*	*
4. List the points which should be observed during starting and running a diesel engine.	*	*	*	*
5. Explain in detail how an engineer should proceed in taking over or relieving the watch duties.		*	*	*
6. Explain in detail the duties of a watchkeeping engineer and the duties of the assistant a watchkeeping engineer during the watch onboard of motor ships.		*	*	*

		A	B	C	D
7.	Explain in detail, what an engineer should observe during his watch period.		*	*	*
8.	List the entries in the engine-room log-book during a watch.			*	*
9.	Describe in detail the examinations, tests and precaution which should be taken in the engine room of a diesel engined vessel in the following cases: (a) before the commencement of a voyage; (b) during the stand-by operation;(c) during voyage; (d) during loading or unloading (berth or anchorage); (e) before entering a dry-dock; (f) during docking; (g) when the ship is to be laid up.	*	*	*	*
10.	Describe the desirable conditions for the combustion of fuel in the cylinder of a main diesel engine. Give typical analysis of the exhaust gas of the engine.	*	*	*	
11.	Describe, how the following faults are detected during the operation of a diesel engine and state their possible effects: (a) afterburing; (b) early ignition; (c) chocked fuel valve; (d) leaking piston ring; (e) too low output.	*	*	*	
12.	Describe an indicator and outline the process of taking indicator diagrams. Explain how the indicator should be treated. List failures arising from the indicator mechanism operation.	*	*	*	
13.	Describe, how diagrams are obtained electronically.	*	*	*	
14.	Sketch and describe power, draw and light spring diagrams. State reasons for taking each one of them.	*	*	*	
15.	State the information which is gained from an indicator diagram. Describe how power balancing is carried out.	*	*	*	
16.	Define and determine: (a) indicated mean pressure; (b) indicated power; (c) real power; (d) brake mean effective pressure.	*	*	*	
17.	Describe, how an engine's brake power is determine by the following methods: (a) Prony's Brake; (b) water brake; (c) electrical braking; (d) torsion meters.	*	*		

	A	B	C	D
18. Explain, how the following can be detected: (a) leaking fuel valve; (b) leaking exhaust valve; (c) leaking air inlet valve; (d) leaking starting air valve; (e) piston overheating.	*	*	*	*
19. State failures and defects of the following engine parts: (a) cylinder heads; (b) pistons, (c) piston rings; (d) cylinders; (e) stulting boxes; (f) bearings; (g) camshafts; (h) crankshafts.	*	*	*	
20. State the main failures of lubrication, cylinder lubrication, air starting, cooling and fuel systems. Give causes and remedies.	*	*	*	
21. Discuss routine tests and operational procedures adopted to ensure that the oil reached the engine in optimum condition.	*	*	*	
22. State the main failures of lub oil and fuel oil filters. Explain how these are defected.		*	*	*
23. Explain alcalinity and acidity for cooling water. State their desired values. Discuss test required and chemicals used to maintain cooling water in proper condition.	*	*	*	
24. State causes of the following failures: (a) accumulation of carbon monoxide on the inlet ports of 2 - stroke engines; (b) piston overheating; (c) liner excessive wear and/or overheating; (d) scavenge fire; (e) piston ring breakage; (f) crankshaft explosion; (g) scavenge explosion; (h) explosion in air starting line.	*	*	*	*
25. State effects of the following: (a) insufficient or excessive liner lubrication; (b) breakage of piston rings; (c) cooling water pump is stopped as soon as the main engine stops; (d) back pressure in exhaust system; (e) exhaust valve opening early; (f) running an engine with more than the recommended maximum liner wear; (g) running the engine for extended periods in unbalance condition.	*	*	*	
26. Describe, how a detail examination of bedplate and crankshaft should be organized and carried out. State possible defects.	*	*	*	

	A	B	C	D
27. Describe in detail the timing of: (a) a 4 - stroke; (b) a 2 - stroke engine.	*	*	*	
28. Explain crankshaft misalignment and outline the methods employed to check misalignment. Describe how measurements are recorded and evaluated.	*	*	*	
29. Give reasons of loss of tension of a chain. State the effects of this and describe how the loss of tension is compensated. Give details of maintenance required. Outline the procedure for replacing a chain.	*	*	*	
30. Describe the procedure for removing and overhauling the following engine parts: (a) piston (crosshead, trunk types); (b) cylinder head; (c) bearings (crosshead, bottom end, main).	*	*	*	*
31. Discuss in detail the overhauling of the following diesel engine parts and list the points which should be given extra attention: (a) fuel valve; (b) air start valve; (c) air inlet valve; (d) air exhaust valve; (e) relief valve; (f) cylinder liner; (g) engine governor; (h) stuffing box.	*	*	*	
32. Describe the preventive and protection devices used to reduce the risk of crankcase explosion. Explain how these devices should be maintained in good order.	*	*	*	
33. Outline the procedures for blowing down and opening up of an auxiliary boiler for cleaning and maintenance. State the points required particular attention.	*	*	*	
34. Discuss in detail the various surveys carried out by classification societies.	*	*		
35. Identify causes of fire in an engine room. State precautions to be taken to eliminate fire hazards. Describe the action to be followed in case of fire.	*	*	*	
E. Calculations.				
1. Solve problems involving the following:	*	*	*	*
(a) cylinder dimensions; (b) duration of valves opening;		*	*	*
(c) speed revolutions; (d)power efficiencies,consumption;	*	*	*	*
(e) combustion heat transfer; (f) stresses.	*	*		

CHAPTER IX

GAS TURBINES

List of Topics:

A. Basic Theory.

B. Description.

C. Operation and maintenance.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Basic Theory.				
1. Describe the following: (a) ideal Joule (constant pressure) cycle; (b) Brayton (open) gas cycle.	*	*	*	
2. Compare Joule and Brayton cycles to the actual gas turbine processes.	*	*	*	
3. Solve problems related to gas turbine performance.	*	*	*	
B. Description.				
1. Describe, with the aid of a line diagram, the principle of operation of gas turbine.		*	*	*
2. Classify the marine gas turbines and state the characteristics of each type.		*	*	*
3. Sketch and describe a gas turbine main propulsion system as intalled on board merchant ships. Name the main components and explain the function of each one of them.		*	*	*
4. Comment on advantages and disadvantages of gas turbine propulsion and compare it to diesel and steam propulsion systems.	*	*		
5. Name essential auxiliaries in a gas turbine plant and explain the function of the various systems and units.		*	*	
6. Name the main control and/or safety systems used in a gas turbine plant and outline their principle of operation.	*	*	*	

		A	B	C	D
7.	State the gas turbine fuel oil requirements.	*	*	*	
8.	Describe, with the aid of line diagrams, the following gas turbine systems: (a) lubricating oil; (b) cooling and (c) fuel oil system.	*	*	*	

C. Operation and Maintenance.

1.	Outline the procedure for starting (a) a gas turbine auxiliary plant and (b) a main propulsive gas turbine plant.	*	*	*	
2.	Outline the procedure for emergency stop of a ship powered by a gas turbine.	*	*	*	
3.	State the measures to be taken in case of emergency in the engine room of a ship powered by gas turbine.	*	*	*	
4.	Outline the duties of the watch engineer officer, in a ship powered by gas turbines.		*	*	*
5.	State the log-book entries, during a watch, in a gas turbine plant.		*	*	*
6.	State troubles, which are very common, in a gas turbine plant.	*	*	*	
7.	Outline the maintenance requirements of a gas turbine power plant.	*	*	*	*
8.	Outline a maintenance programme of a gas turbine power plant.	*	*		

GENERAL MARINE ENGINEERING KNOWLEDGE

List of Topics:

A. Piping Systems.
B. Pumps and Pumping.
C. Air Compressors.
D. Heat Exchangers.
E. Various Machine Appliances.
F. Shafting.
G. Steering Gears.
H. Stabilizers.
I. Refrigeration.
J. Deck Machinery.
K. Duties of Marine Engineer Officers.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Piping Systems.				
1. Describe, with the aid of line diagrams, the following systems: (a) ballast; (b) engine room and cargo spaces bilge; (c) fire; (d) sanitary; (e) domestic water (cold and hot); (f) fuel oil transfer and bunkering; (g)circulating water; (h) cooling water; (i) lubricating oil; (j) feed water; (k) steam; (l) compressed air; (m) hydraulic. Name all fittings and state their function for each one of the above systems.	*	*	*	*
2. Describe how the flow through a piping system is automatically and remotely controlled.	*	*		
3. List the machinery and auxiliaries found in motor and in steam ships.			*	*
4. State materials used in the construction of pipes for each one of the systems listed in question 1 above.	*	*	*	

	A	B	C	D
5. Explain how expansion and contraction of pipes are accommodated.	*	*	*	
6. Discuss protective fitting and lining of pipes.	*	*	*	
7. Describe, with the aid of sketches, the following valves: (a) globe; (b) gate; (c) butterfly; (d) chest; (e) valve actuators; (f) control valves; (g) pressure reducing; (h) quick closing.	*	*	*	*
8. Describe, with the aid of sketches, the construction of the following traps: (a) mechanical; (b) thermostatic; (c) thermodynamic; (d) vacuum.	*	*	*	
9. Classify strainers according to: (a) their function; (b) materials of construction; (c) perforation size.	*	*	*	
10. Discuss maintenance for piping valves, traps and strainers.	*	*	*	*
11. Describe the shipboard drinking water treatment.	*	*	*	

		A	B	C	D
B.	Pumps and Pumping.				
1.	Sketch and describe the following pumps: (a) displacement; (b) rotary; (c) centrifugal. Calculate their pumping capacity.	*	*	*	*
2.	List the various forms of rotary pumps. State speeds and applications for each form.		*	*	*
3.	Explain and calculate suction and discharge heads. Calculate pump efficiency and friction losses.	*	*		
4.	State the purpose and estimate the size of an air and vacuum chamber as is used in a reciprocating pump.		*	*	
5.	Explain how vacuum is created and maintained in the suction of rotary and centrifugal pumps. Describe the various air handling methods in use. Outline the maintenance required.	*	*	*	*
6.	Describe, with the aid of sketches, the pump shaft sealing arrangements. Outline the maintenance required.		*	*	*
7.	Sketch and describe pumps for the following applications: (a) fire system; (b) main sea water system; (c) boiler feed water system; (d) condensate extraction; (e) lubricating oil (diesel and steam); (f) cargo systems.	*	*	*	
8.	Describe care and maintenance for the various pumps and pumping systems.	*	*	*	
9.	Outline the procedure for starting a pump.			*	*

	A	B	C	D
C. Air compressors.				
1. List the various types of compressors and state marine applications for each type. Identify uses of compressed air on board merchant vessels.			*	*
2. Describe, with the aid of sketches, the principle of operation of a centrifugal compressor. State advantages and disadvantages of centrifugal compressors.		*	*	*
3. Illustrate the cycle of operation, of a reciprocating compressor with intercooling, on P.V. diagram and explain the various operations shown; insert pressures and temperatures at salient points. Describe the procedure for obtaining P.V. diagrams for reciprocating compressors.	*	*		
4. Calculate volumetric efficiency, mechanical efficiency and clearance volume for a reciprocating compressor from indicator (P.V.) diagram.	*	*		
5. Sketch and describe a two stage reciprocating air compressor. Describe the measurement and adjustment of clearances. Describe any safety features which guard against excess pressures.		*	*	*
6. Describe, with the aid of sketches, a compressed air piping system, suitable for marine installation, fitted with automatic operation control system. Show and name all parts and fittings.		*	*	*
7. State and/or describe the following:				
(a) required properties for compressor oil;	*	*	*	
(b) lubrication methods for reciprocating compressors;		*	*	*
(c) operation monitoring of compressors;	*	*	*	
(d) points to be attended in order to prevent accidents;	*	*	*	*
(e) cleaning process of compressors' internal parts;		*	*	*
(f) scale removal from cylinder jackets;			*	*
(g) overhauling of suction and delivery valves;		*	*	*
(h) checking for possible oil leaks;	*	*		
(i) restoration of the desired piston clearance valves.	*	*		

	A	B	C	D
8. State the effects of the following:				
(a) unloaded running for long periods;	*	*	*	
(b) starting in loaded condition;		*	*	*
(c) operation without air inlet filter;		*	*	*
(d) operation with chocked air filter;			*	*
(e) too high or too low air inlet temperature;	*	*	*	
(f) too cold cooling water;	*	*	*	
(g) excessive clearance volume;		*	*	*
(h) insufficient drainage of compressors and air receivers.			*	*
9. State reasons of the following reciprocating air compressor troubles:				
(a) groaning noises in cylinders;	*	*	*	
(b) compressor's explosions;	*	*	*	
(c) automatic shut off;	*	*	*	*
(d) intercooling temperature too low or too high;		*	*	*
(e) valve seat erosion;		*	*	*
(f) reduction of capacity;		*	*	*
(g) excessive clearance volume.		*	*	*
10. Describe the operation of overhauling a two stage reciprocating air compressor. Give details of the necessary tests before the compressor is put back into service and the precautions to be observed when putting it back into service.	*	*	*	*

		A	B	C	D
D.	Heat Exchangers.				
1.	Explain how heat flows from one liquid or gas to another. Calculate the thermal performance of a heat exchanger using simple equations.	*	*	*	
2.	Classify the marine heat exchangers according to their application and construction.		*	*	*
3.	Describe, with the aid of sketches, a shell and tube type water cooler. Show how liquids are separated and how expansion is accommodated. State the materials used for the construction of shell, tubes and tube blades.	*	*	*	*
4.	Describe heat exchanging process in a plate type heat exchanger.			*	*
5.	Name suitable heat exchangers for the following cases: (a) oil heaters; (b) water heaters; (c) air preheaters; (d) sea water heaters.			*	*
6.	Describe the construction of a condenser. State the factors which govern the design of a condenser. List the various fittings of a main condenser and explain how its vacuum is created and maintained. Give the materials used for condenser construction and list the main condenser failures.	*	*	*	*
7.	Describe, with the aid of a sketch, the principle of operation of a two stage air ejector.	*	*	*	
8.	Describe, with the aid of a line diagram, a distilling plant. Name all parts and fittings and state their function.	*	*	*	*
9.	Describe, with the aid of a line diagram, the operation of a flash evaporator. State the advantages and disadvantages of sub-atmospheric evaporation. Describe boiling evaporation process.	*	*	*	*
10.	Describe a cascade type de-aerator. Outline the de-aeration process. State the purpose of de-vaporizers	*	*	*	*
11.	State the main heat exchangers failures. Identify the importance of venting and draining for efficient operation of heat exchangers. State the attention required during operation of a heat exchanger.	*	*	*	*

		A	B	C	D
E.	Various Machines and Appliances.				
a.	Oil/water separators.				
1.	State MARPOL Convention requirements for oil/water separators.	*	*	*	
2.	Describe the principle of operation of oil/water separators. Discuss the separation force.	*	*	*	
3.	Using sketches, describe a two stage oil/water separator. State the function of the various controls fitted in the system.		*	*	*
b.	Fuel and Lubricating Oil Treatment.				
4.	State the purpose of oil centrifuging. Calculate the centrifugal force.	*	*	*	
5.	Sketch and describe a tubular type and a disc type centrifuge. Explain how oil is passed through centrifuges.	*	*	*	*
6.	Describe, with the aid of line diagrams, a fuel oil and a lubricating oil treatment systems.		*	*	*
7.	Outline the setting into service, automatic cleaning and cutting down procedures of a disc type centrifuge (De-Laval). State the care and maintenance required.		*	*	*
c.	Sewage Treatment.				
8.	State the MARPOL Convention requirements on sewage efluent discharge.				
9.	Describe, with the aid of sketches and diagrams, a chemical and a biological sewage treatment system. Name the parts and fittings shown and explain the function of each one.	*	*	*	*
10.	State the purpose of an incinerator on board ship. Describe the operation of an incinerator suitable for burning solid and liquid wastes.		*	*	*

	A	B	C	D
F. Shafting.				
1. Describe, with the aid of a sketch, a propeller shaft bearing. Explain in detail how the bearing is lubricated.	*	*	*	
2. Sketch and describe a thrust block; explain its principle of operation. State the maintenance and care required.	*	*	*	
3. Describe briefly how the alignment of a propeller shaft is checked.	*	*		
4. Describe, with the aid of sketches, a stern tube construction and arrangement. Explain how a stern tube is lubricated and show in detail, with the aid of sketches, the sealing arrangements.	*	*	*	*
5. Describe how a damaged propeller is repaired. Outline, with the aid of sketches, the methods for mounting a propeller.	*	*	*	

		A	B	C	D
G.	Steering Gears.				
a.	Description.				
1.	State the requirements of International Regulations for steering gears.	*	*	*	
2.	Describe, with the aid of a line diagram, the principle of operation of steering gears.	*	*	*	*
3.	Show diagrammatically, the general arrangement of the following types of steering gear systems: (a) the ram and cylinder type; (b) the vane type; (c) the electical steering gear.	*	*	*	*
4.	Show diagrammatically and explain how a steering gear is controlled from a remote position.	*	*	*	*
b.	Maintenance.				
5.	Describe the procedure for the following processes: (a) replacing fluids in steering gear systems; (b) venting the ram of an electrohydraulic steering system; (c) changing over from main to auxiliary steering and vice-versa.	*	*	*	*
6.	List the most common failures of steering gear systems and explain how these failures are avoided or their effects are eliminated.	*	*	*	*
7.	Describe, with the aid of sketches, two auxiliary means of steering. Explain how these are set into service in case of emergency.	*	*	*	*
8.	Describe some special steering devices.	*	*	*	

		A	B	C	D
H.	Stabilizers.				
1.	Illustrate the degrees of freedom of a ship at sea.	*	*	*	*
2.	Define and calculate natural roll period for a ship.	*	*	*	
3.	Explain how tank stabilizers generate anti-rolling forces.	*	*	*	*
4.	Explain the action of bilge keels. State their advantages.	*	*	*	*
5.	Explain how stabilizing power of fin stabilizers is generated. Describe, with the aid of a line diagram the principle of control of a fin stabilizing system.	*	*	*	

		A	B	C	D
I.	Refrigeration.				
1.	Describe, with the aid of temperature - entropy (T - S) and pressure - enthalpy (P - S) diagrams, the cycle of operation of a refrigerator.	*	*	*	
2.	State and calculate coefficient of performance of a refrigeration plant. State a refrigeration plant capacity units.	*	*		
3.	List the main types of refrigeration plants. State the characteristics of each type.	*	*	*	
4.	Illustrate diagrammatically and describe the components of the vapour compression system. State the function of each component shown.	*	*	*	*
5.	Describe compressors and heat exchangers used in refrigerating plant.	*	*	*	*
6.	Describe the most common refrigerant controls and outline the principle of operation of each one.	*	*	*	
7.	List the most common refrigerants used on board ships and outline the characteristics of each one. State the safety precautions which should be taken when working with the above listed refrigerants.	*	*	*	*
8.	Outline the following methods: (a) defection of refrigerant leakage; (b) replenishing or adding refrigerant; (c) repairing a refrigerating system.	*	*	*	
9.	State rasons for the following troubles and describe recommended remedies: (a) air or non-condensable gas in system; (b) high head pressure; (c) low head pressure; (d) high suction pressure; (e) compressor short cycles (low or high pressure cut out); (f) compressor runs continuously; (g) compressor noisy; (h) compressor doesn't start.	*	*	*	
10.	Outline the methods used to cool a refrigerated chamber. Describe how refrigated chambers are insulated.	*	*	*	
11.	Outline the methods used to measure temperatures in cargo spaces.	*	*	*	
12.	State temperatures for meat, fish, vegetables and butter in frozen and chilled conditions.	*	*	*	*

		A	B	C	D
J.	Deck Machinery.				
1.	Describe the main forms of drive of deck machinery. State advantages and disadvantages of each form.		*	*	*
2.	State the main requirements for the anchor handling gear. Describe the principle of operation of an anchor windlass. Explain the securing of anchor chain.	*	*	*	*
3.	Describe the under deck securing of deck machinery.			*	*
4.	State requirements for an efficient cargo handling gear.	*	*	*	
5.	Compare deck cranes to cargo derricks. State the advantages of each form of cargo handling.			*	*
6.	Describe the various types of cargo covers. State the types of machinery employed to handle cargo covers.		*	*	*
7.	Describe, with the aid of sketches, the brake systems which are employed in anchor, mooring and cargo handling gear.	*	*	*	
8.	List the most commom failures of deck machinery. State the importance of regular maintenance for deck machinery. State the points which should be listed in a routine maintenance programme.	*	*	*	

		A	B	C	D
K.	Duties of Marine Engineer Officers.				
1.	State the duties of chief engineer, second engineer, watchkeeping engineer and electrician on board of a ship.	*	*	*	*
2.	State the duties of engine ratings on board of a ship.	*	*	*	*
3.	State the duties of the deck and catering departments' officers and ratings.	*	*	*	*
4.	Explain how fuel, water and oil capacities are estimated.	*	*	*	*
5.	Outline the duties of the engine department crew in case of emergency either in engine room or elsewhere.	*	*	*	*
6.	Describe how an engine watch is conducted on board of a motor ship and on board of a steam ship.	*	*	*	*
7.	State the purpose of an engine log book. What entries should be made; Discuss other official documents which should be maintained by the engine department.	*	*	*	*
8.	Name and describe ship documents which are kept by the ship's master.	*	*	*	
9.	Discuss in detail the survey requirements for marine machinery.	*	*	*	
10.	Describe the procedure for ordering (a) spare parts; (b) consumable materials; (c) fuel and lubricants. State the information which should be provided in each case.	*	*	*	
11.	Describe how a computer aided system should be introduced to deal with spare parts and maintenance affairs. State other possible computer applications in the engine department.	*	*		
12.	Explain how a team, to deal with major repairs such as a main piston overhauling, should be organized.	*	*	*	
13.	Outline the procedures for carrying out major engine repair work on board of a ship. State safety precautions which should be taken.	*	*	*	
14.	List, as many as possible, safety rules, which should be always in mind of an engineer when on board of a ship.	*	*	*	*

ELECTROTECHNOLOGY

List of Topics:

A. Basic Principles.

B. D.C. System.

C. A.C. System.

D. Operation and Maintenance.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Basic Principles.				
1. Give the basic S.I. quantities and state other important quantities. State the relation between various quantities and make calculations on them.	*	*	*	*
2. Describe, with the aid of diagrams, the elements of a basic electric circuit.		*	*	*
3. State and explain Ohm's and Kirchhoff's laws. Solve problems involving laws.	*	*	*	*
4. Describe ammeters and voltmeters. State their use.	*	*	*	*
5. Discuss conductors and insulators. Explain how their resistance varies with dimensions material and temperature.	*	*	*	*
6. Solve problems involving resistance, capacitance and inductance.	*	*	*	
7. Explain and/or describe in brief the following: (a) electrolysis; (b) laws of electrolysis; (c) Primary and Secondary cells.	*	*	*	*
8. Explain the properties of a magnet. State the Faraday's and Lenz's Laws on electromagnetic induction.		*	*	*
9. Explain the generation of e.m.f. due to (a) static and (b) dynamic induction.	*	*	*	*

	A	B	C	D
10. Describe the principle of operation of magneto-dynamo. Explain the generation of a.c. and d.c. currents.	*	*	*	*

B. D.C. System.

a. D.C. Generators.

1. Describe, with the aid of sketches, the construction of d.c. genereto r. Name the various parts and fittings of a d.c. generator and explain the function of each one.	*	*	*	*
2. Describe, with the aid of diagrams, the d.c. generator's armature winding arrangements.	*	*	*	
3. Write and explain the e.m.f. equation explaining all factors. Solve problems on the equation.	*	*	*	
4. State the differences in construction between the permanent magnet type and the separately exited type generator. State the characteristics of each type.	*	*	*	
5. Describe, with the aid of sketches, the following types of d.c. generators: (a) shunt - connected; (b) series-connected and (c) compound-connected. State advantages and marine applications of each type.	*	*	*	

b. D.C. Motors.

6. Explain the principle of operation of d.c. motors. State voltage, current and speed equations for d.c.motors.	*	*	*	*
7. Describe the following types of d.c. motors explaining their characteristics: (a) shunt; (b) series; (c) compound.	*	*	*	
8. Describe the starter of d.c. motors. Explain how the speed of a d.c. motor is controlled.	*	*	*	

c. D.C. Machines.

9. Explain electrical, mechanical and other losses of d.c. machines.	*	*	*	
10. Describe methods for efficiency output estimation. Calculate efficiency for d.c. machines.	*	*	*	
11. Name and describe shipboard applications of d.c.machines.	*	*	*	

		A	B	C	D
d.	D.C. Switchboard.				
12.	Describe, with the aid of drawings, a d.c. switchboard. Show and name the main devices. State advantages of (a) open and (b) dead-front switchboard.	*	*	*	
13.	Discuss briefly the following, with reference to d.c. switchboard: (a) reverse current protection; (b) instruments; (c) preferential tripping; (d) dashpots; (e) earth indication; (f) pilot lamps; (g) protection against short circuit; (h) fuses.	*	*	*	
14.	Describe the construction and installation of busbars. Explain,how busbars are kept cool and how they are protected from short circuits.	*	*		
C.	A.C. System.				
a.	A.C. Theory.				
1.	Explain, with the aid of sketches, the generetion of a.c. waveform.			*	* *
2.	Represent sinusoidal alterating quantities. Solve problems involving addition and subtraction of sinusoidal quantities.	*	*	*	
3.	Explain mean square root and average values.	*	*	*	
4.	Explain: (a) impedance; (b) inductance; (c) capacitance. Describe their characteristics. Solve problems involving impedance, inductance and capacitance in series and in parallel.	*	*	*	
5.	Describe a polyphase system. Describe: (a) star connection; (b) delta connection. State the characteristics of each connection.	*	*	*	
b.	Generator.				
6.	Describe, with the aid of sketches, an a.c. generator. Name the various parts and explain their construction .			*	* *
7.	State and describe the main a.c. generator types. Give the application of each type.	*	*	*	

	A	B	C	D
8. Explain, with the aid of drawings the types of exitation of a.c. generators. Discuss in brief stator windings.	*	*	*	
9. State the speed-frequency and e.m.f. equations and solve problems on them.	*	*	*	
10. Explain, why sinusoidal conditions are desirable in a.c. generation. Explain, how these conditions are obtained.	*	*	*	*
11. Draw and explain the complete phasor diagram. State the information which is collected from the diagram.	*	*		
12. Explain, with the aid of curves, the relation between exitation and load.	*	*	*	
13. State the problems associated with constant frequency when shaft generators are used on shipboard installations.	*	*		
14. Explain the principle of operation of the following generator protection systems: (a) preference; (b) overcurrent; (c) differential; (d) earth fault; (e) overload; (f) loss of exitation; (g) undervoltage; (h) combine.	*	*	*	
15. State the instruments which are required to be fitted to an a.c. generator which is to be generated in parallel. Explain why current and voltage transformers are used.	*	*	*	
16. Describe the synchronoscope and the synchronizing panel. State the requirements for parallelizing two generators. Explain the functions of check synchronizer.	*	*		
17. Describe the procedure for synchronizing and parallelizing two a.c. generators.	*	*	*	*
18. Describe the automatic control system of a diesel generator set. Explain the function of the various controls	*	*	*	
c. Motors.				
19. State the main advantages of a.c. motors as compared to d.c. motors. Describe the main types of a.c. motors and state the characteristics and applications of each type.		*	*	*
20. Describe the following types of protective devices which are used in a.c. motors: (a) magnetic overload relays; (b) thermal overload.		*	*	*

	A	B	C	D
21. With the aid of sketches, describe the following a.c. motor starters: (a) star-delta starter; (b) auto-transformer starter.		*	*	*
d. Transformers and Circuit Breakers.				
22. Explain the principle of operation of transformers. Describe briefly voltage and current transformers. State their application.	*	*		
23. Explain the internal drop of a transformer and calculate percentage of voltage drop.	*	*		
24. Describe the characteristics of a transformer (a) on load and (b) on unload conditions. Calculate the efficiency of a transformer.				
25. Explain the following transformer tests: (a) open circuit test; (b) short circuit test; (c) direct loading test.	*	*		
26. Describe the construction and explain the principle of operation of an a.c. circuit breaker suitable for a.c. switchboard installation. State factors which should be considered in circuit breaker construction.	*	*	*	*
27. Describe the miniature and moulded case circuit breakers. Explain their advantages and list their applications.	*	*	*	
28. Explain why the system voltage, the rated load current and the fault level at the point of installation are very important decisive factors in the selection of the circuit breaker.	*	*	*	
D. Operation and Maintenance.				
1. Describe the procedure for starting a diesel-generator set. State the safety precautions which should be taken.	*	*	*	*
2. Describe the procedure which should be followed in synchronizing and parallelizing (a) d.c. generators; (b) a.c. generators.	*	*	*	*
3. State the precautions which should be taken when starting a motor. Outline the procedure for starting an a.c. motor.	*	*	*	*

	A	B	C	D
4. Explain how accumulation of dirt, oil, or grease is removed from electrical equipment.	*	*	*	*
5. Explain the methods for drying the insulation on winding.	*	*	*	
6. State the attention to be given a large motor which is being shut down for long period.	*	*	*	*
7. Explain how steering gear motors are protected against overcurrent.	*	*	*	
8. State the periodic inspections required for emergency generators and lifeboat winches.	*	*	*	*
9. State the safety precautions which should be taken when working in the following areas: (a) with the main switchboard; (b) with a motor; (c) in a hazardous area; (d) with the lighting system.	*	*	*	*
10. State the main types of electric cables used on board ships. Describe their insulation.	*	*	*	
11. Explain the importance of insulation in electrical systems. Explain, with the aid of sketches, how insulation resistance is measured. Describe the construction of an insulation resistance measuring instrument.	*	*	*	
12. Describe the construction of batteries and state their uses on board ships. Explain,how batteries are connected.	*	*	*	
13. Explain the safety precautions which should be taken when batteries are charged. Describe the testing of batteries.	*	*	*	*

CHAPTER XII

ELECTRONICS

List of Topics:

A. Introduction.
B. Passive Components.
C. Diodes, Transistors, Thyristors.
D. Photo Electric Devices.
E. Logic Elements and Digital Devices.
F. Microprocessors.
G. Amplifiers.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Introduction.				
1. Describe the structure of the atom. Name the atom particles.			*	*
2. Describe in detail the atomic structure of an insulator, a semiconductor and a conductor. Explain, why silicon is very extensively used in electronics.		*	*	*
3. Explain,how atoms bond together. Define valence electrone, forbidden bond, covalent bonding and electrovalent bonding.		*	*	*
4. Draw and explain a crystal lattice. Describe the formation of a hole. Explain the addition of impurities to pure semiconductor.		*	*	*
5. With the aid of a sketch, describe the principle of operation of a cathode-ray tube. Show and explain its components.	*	*		
6. Describe, with the aid of a block diagram, the basic components of a cathode-ray oscilloscope. State its applications.	*	*		

	A	B	C	D
B. Passive Components.				
1. Define fixed resistors and variable resistors. State the characteristics of each type. Give examples of fixed and variable resistors.		*	*	
2. Describe a capacitor and state its characteristics. Define a fixed and a variable capacitor. Give examples and applications.	*	*	*	*
3. Describe the charging and discharging effects of a capacitor in d.c. circuit.	*	*		
4. Determine resistance and tolerance of fixed resistors and capacitive value, tolerance and working voltage of fixed capacitors by use of colour codes and printed codes.	*	*	*	
5. State characteristics of inductors and explain the uses of inductors in electronic circuits.		*	*	*
6. State characteristics of positive and negative coefficient type resistors. State applications for photo-cells, photo-transistors and photo-resistors.	*	*		
C. Diodes, Transistors and Thyristors.				
1. Define a p-type and an n-type semiconductor. Describe the formation and the behaviour of p-n junction.	*	*	*	*
2. State the characteristics of a semiconductor p-n diode. Define, with the aid of sketches, forward and reverse bias. Solve problems involving diodes.	*	*	*	
3. State applications and draw the symbol of zener diode. State applications of tunnel diodes, light-emitting diodes and photo diodes. Explain how light is emitted from a p-n junction.	*	*	*	
4. Sketch a basic stabilizer circuit comprising zener diode, series ballast resistor and load resistor. Describe how the circuit stabilizes the output voltage against changes in supply voltage and load current.	*	*		

	A	B	C	D
5. Explain the principle of operation of the transistor regulator and its introduction into a voltage stabilizing circuit.	*	*		
6. Calculate the value of series resistor for variations in supply voltage and load resistor.	*	*		
7. Explain the function of each componet in a typical transistored series stabilized power supply. Describe the operation of the circuit when the load and/or the supply voltage varies.	*			
8. Explain the operation of the transistor and state its characteristics. Describe the transistor as a switch to drive lights and relays.	*	*	*	
9. Explain the operation of the unijunction transistor (UJT), with the aid of a suitable diagram.	*	*		
10. Describe a thyristor and explain principle of operation of the thyristor. Describe marine applications for thyristors.		*	*	*
11. Compare a thyristor to a transistor. State the advantages of the thyristor.		*	*	*
12. Explain the dependence of maximum rating on the use of a heat sink.		*	*	*
13. With the aid of sketches, show methods of triggering.	*	*	*	
14. Explain, with the aid of a basic diagram, the operation of a basic d.c./a.c. inverter.	*	*	*	

D. Photo Electric Devices.

1. State the principle of operation of photo-electric devices. Give applications in the maritime field.	*	*	*	
2. Describe, with the aid of sketches, the construction and operation of a photo-conductive and photo-voltaic cells. State their characteristics.	*	*	*	
3. Describe the principle of operation of the photo diode and the photo transistor.	*	*	*	
4. Draw basic block schematic diagrams of a smoke detector and a flame detector. Explain their operation.	*	*		

		A	B	C	D
E.	Logic Elements and Digital Devices.				
a.	Logic Elements.				
1.	Produce the truth tables and Boolean notation AND, OR, NOT, NAND,NOR and EXCLUSIVE - OR functions.	*	*	*	
2.	Explain the principle of operation of electronic switching. State applications for (a) diode switches and (b) transistor switches.	*	*		
3.	Describe two stage and three stage logic using circuits.	*	*		
4.	With the aid of simple systems, explain a transistor flip-flop.	*	*		
5.	Explain an integrated circuit.	*	*		
b.	Digital Devices.				
6.	Convert Binary to decimal numbers and vice-versa. Perform calculations in Binary arithmetic.	*	*	*	
7.	Apply De Morgan's theorem in NAND operations.	*	*		
8.	State applications of digital circuits.	*	*		
9.	Explain the principle of operation of a digital counter.	*			
F.	Microprocessor Systems.				
1.	Draw a general block diagram of a program controlled system to show input unit, output unit, memory, control unit, arithmetic-logic unit. Explain the role of the microprocessor in the diagram.	*	*	*	*
2.	Define: (a) immediate access memory; (b) backing store memory; (c) 'read', 'write', 'output'; (d) bit, byte, word.	*	*	*	
3.	State the functions of ROM, RAM, and ERROM in a complete memory system.	*	*	*	
4.	Write and read a flowchart.	*	*		
5.	State applications of microprocessors on board ships.	*	*	*	*
G.	Amplifiers.				
1.	Describe the basic amplifier. Explain the small-signal				

		A	B	C	D
	equivalent circuits for an amplifier for both the constant current and the constant voltage cases.	*	*		
2.	Derive the expression for the voltage, current and power gains of an amplifier.	*	*		
3.	Explain the operation of a common-emitter amplifier for handling large signals (d.c. and a.c. load lines). Derive the expression for the voltage, current and power gains and solve problems relating to the gains.	*	*		
4.	Explain, with the aid of a circuit drawing, a single stage differential amplifier. Explain differential and single-ended gains.	*	*		
5.	State the differences between an ideal and a practical operational amplifier.	*	*		
6.	Draw the diagram of an operational amplifier connected as follows: (a) inverting; (b) non-inverting amplifier; (c) integrator.	*	*		
7.	State the relationship between gain and percentage proportional band.	*	*		

CHAPTER XIII

AUTOMATION, CONTROL AND INSTRUMENTATION

List of Topics:

A. Automatic Control Principles.
B. Measuring Instruments.
C. Signal Conditioning.
D. Transducers.
E. Controllers.
F. Final Control Element.
G. Practical Control Systems.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Automatic Control Principles.				
1. Define and explain the concept of process control.			*	*
2. Draw a block diagram of a basic control and state the function of each element shown in the diagram.		*	*	*
3. Explain the difference between open and closed loop control systems.		*	*	*
4. State examples of open and closed control loop systems found aboard ships and outline their operation.		*	*	
5. Define : (a) dynamic response; (b) transient response and (c) feedback.		*	*	*
6. Explain the evaluation criteria for dynamic response (settling time, peak error, residual error, cycling, minimum area).	*	*		
7. Explain the time lags which exist in control loops, state their effects on the loops and suggest ways to reduce the lag effects on the closed loop system.	*	*	*	
B. Measuring Instruments.				
1. Explain the principle of operation of the following				

	A	B	C	D
instruments:	*	*	*	*
(a) Temperature measuring instruments		*	*	*
(i. liquid in glass thermometer, filled system thermometer, thermocouple, optical pyrometer)			*	*
(ii. filled system thermometer, optical pyrometer)		*		
(b) Pressure measuring instruments	*	*	*	*
(i. water manometer, mercury manometer, mercury barometer, boordon and schaffer types gauges)				*
(ii. water manometer, mercury manometer, mercury barometer, boordon and schaffer type gauges, piezoelectric detecting sensor)			*	
(iii. differential pressure cell, piezoelectric detecting sensor)		*		
(iv. piezoelectric detecting sensor)	*			
(c) Level measuring instruments	*	*	*	*
(i. sight glass, remote water level indicator, igema water level indicator, pneumercator level indicator)			*	*
(ii. capacitive level sensor, remote water level indi-tor, igema water level indicator, pneumercator level indicator)		*		
(iii. capasitive level sensor)	*			
(d) Flow measuring instruments	*	*	*	*
(i. mechanical type flow-meter, rotameter for flow measurement)				*
(ii. mechanical type flow-meter, rotameter for flow measurement, venturi tube flow-meter)			*	
(iii. electromagnetic flow-meter, venturi tube flow--meter, mechanical, electrical and square root extractors)		*		
(iv. Electromagnetic flow-meter, mechanical, electical and square root extractors)	*			
e. Other measuring instuments	*	*	*	*
(i. smoke density detector, oil mist detector, ph sensor, fire detector, explosionmetem,oxygen analysers, CO2 analysers, dionic water purity meter)				*
(ii. viscometer, smoke density detector, oil mist				

		A	B	C	D
	detector, ph sensor, fire detector, explosionmeter, oxygen analysers, CO2 analysers, dionic water purity meter)			*	
	(iii. tachometers, torque power measuring instrument, viscometer, photo electric cells, oil-in-water detector, smoke density detector, oil mist detector, ph sensor, fire detector, explosionmeter, oxygen analysers, CO2 analysers, dionic water, purity meter, dissolved oxygen meter)	*	*		
2.	Outline the procedure for test, adjustment and calibration of the above (question 1)instruments.	*	*		
C.	Signal Conditioning.				
1.	Define the AND, OR, NOT, NAND and NOR functions of Boolean Algebra.		*	*	*
2.	Solve simple logic circuit problems by constructing truth tables.	*	*	*	
3.	Define digital word and explain decimal and binary number systems.			*	*
4.	Convert decimal numbers to binary numbers and vice versa.	*	*	*	*
5.	State the advantages and disadvantages of (a) analog and (b) digital processing.	*	*	*	*
6.	State the difference between serial and parallel transmission mode.	*	*		
7.	Explain the principle of operation of comparators.	*	*	*	
8.	Explain the principle of operation and list the characteristics of Analog to Digital Converter (ADC) and Digital to Analog Converter (DAC).	*	*	*	
9.	State the characteristics of:(a) analog signal conditioning and (b) digital signal conditioning.		*	*	*
D.	Transducers.				
1.	Compare mechanical and thermal transducers.		*	*	

	A	B	C	D
2. Explain the principle of operation of the Resistance Temperature Detector (RTD), Thermistors and Thermocouples.	*	*	*	
3. Explain the principle of operation of mechanical transducers when used to measure, displacement, acceleration, stress and strain and pressure and fluid flow.	*	*	*	
4. Explain the principle of operation of the following transducers,using sketches:	*	*	*	*
(a) position balance and force balance (pneumatic);		*	*	*
(b) electropneumatic;	*	*		
(c) variable inductance;	*	*		
(d) variable contact resistance;			*	*
(e) variable capacitance;	*	*		
(f) electronic force balance;	*	*		
(g) voltage current;	*	*	*	
(h) receiver integrator;	*	*		
(i) position motors;		*	*	*
(j) electric telegraph.		*	*	*

E. Controllers.

1. State and justify the application of operational amplifier in process control.	*	*		
2. List the characteristics of the following amplifiers: (a) voltage follower; (b) inverting amplifier; (c) non inverting amplifier; (d) differential amplifier; (e) integrator; (g) differentiator and (h) proportional/integral amplifier.	*			
3. Illustrate the output of the following controller modes: (a) ON/OFF; (b) proportional; (c) integral; (d) derivative; (e) proportional/integral; (f) proportional/derivative and (g) proportional/integral/derivative.	*	*	*	*
4. State the advantages,disadvantages and characteristics of each one of the above seven controllers.		*	*	*
5. Define amplification and proportional band and state the interrelation between them.	*	*	*	

	A	B	C	D
6. Outline the method Ziegler - Nichols for optimization of control loops.	*	*		
7. Show,with the aid of sketches,the operating principle of the pneumatic flapper/nozzle controller, explaining the need for feed back.	*	*	*	
8. Explain the principle of operation of a two and three term electronic controllers.	*	*		
9. Explain the principle of operation of the following controllers: (a) mechanical hydraulic controller; (b) fuel-air ratio controller (Baily) and (c) viscosity controller (viscotherm).	*	*	*	
F. Final Control Element.				
1. State the function of the parts of the final control system.			*	*
2. Outline the main techniques used to convert the controller output signal into the actuator input signal.	*	*	*	
3. Describe the main types of actuators (electrical, hydraulic, pneumatic, mechanical).	*	*	*	
4. With the aid of sketches outline the operation of the final control element employing the following actuators: (a) DC and AC electric motors; (b) hydraulic ram; (c)hydraulic rotary vane and (d) pneumatic piston.	*	*	*	*
G. Practical Control Systems.				
1. Outline, with the aid of block diagrams, the operation of the following control systems and state the methods by which these systems are optimized:	*	*	*	*
(a) viscosity control;		*	*	*
(b) lubricating oil temperature control;		*	*	*
(c) jacket water temperature control;		*	*	*
(d) boiler water level control;		*	*	*
(e) combustion control;	*	*	*	

	A	B	C	D
(f) steam temperature control;		*	*	*
(g) gland steam control;	*	*	*	
(h) bridge control systems for motor and steam turbine powered ships;	*	*	*	
(i) auxiliary boiler fuel control;	*	*	*	
(j) controllable pitch propeller control.	*	*		
2. Solve problems on automation control and instrumentation involving: principles, measurement, signal conditioning, transducers, controllers and actuators.	*	*	*	

CHAPTER XIV

SHIP CONSTRUCTION AND NAVAL ARCHITECTURE

List of Topics:

A. Ship Construction.

B. Naval Architecture.

C. Damage Control.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Ship Construction.				
1. Give ,with the aid of sketches, the ship's principal dimensions.		*	*	*
2. State the main definitions used in shipbuilding.		*	*	*
3. Explain,with the aid of sketches, the construction details and state the function of the following components of ship's structure: (a) double bottom; (b) side shell; (c) decks; (d) pillars and girders; (e) bulkheads; (f) hatches; (g) structure forward of collision bulkhead; (h) structure aft of aft peak bulkhead; (i) superstructure; (j) ship's stern.	*	*	*	
4. List the materials used in shipbuilding.			*	*
5. Describe the main ship types and sketch their midship sections.			*	*
6. Identify the method of structural fire protections applied to passenger ships and tankers.	*	*		
7. Explain natural and mechanical ventilation systems for the following spaces: (a) cargo holds; (b) pump room; (c) engine room.		*	*	*
8. Name the main types of rudders and state the characteristics of each type.	*	*	*	*
9. State the function of ship stabilizers and outline the stabilizing methods.	*	*	*	

	A	B	C	D
10. Outline the methods used to resist ship corrosion and to prevent fouling.	*	*	*	
11. State the function of classification societies.	*	*	*	
12. Outline the surveys required to obtain and maintain class.	*	*		
13. Explain why freebord is required.	*	*	*	*
14. State the factors which affect to position of load line mark and sketch the load line mark.	*	*	*	*
15. State the components of gross tonnage and net tonnage.	*	*	*	
16. Define ship form and explain 'lines plan' and 'moulded lines'.	*	*		

B. Naval Architecture.

a. Hydrostatic Calculations.

1. Define block coefficient, prismatic coefficient, midship area coefficient, waterplane area coefficient, vertical prismatic coefficient and calculate them.	*	*	*	
2. Apply Archimedes principle to floating bodies.	*	*	*	
3. Solve problems involving change in draught due to changes in density of water.	*	*	*	
4. Define and calculate ship displacement.	*	*	*	
5. Plot the displacement curve for a range of draughts.	*	*		
6. Define buoyancy and relate buoyancy to displacement.	*	*	*	
7. Define centre of buoyancy and centre of gravity.	*	*	*	
8. Calculate total buoyancy.	*	*		
9. Define and calculate wetted surface area.	*	*		
10. Define TPC and produce TPC curve against draught.	*	*	*	
11. Use TPC to determine the change in mean draught due to addition or removal of masses.	*	*		
12. Use Simpson's rules to calculate:				
(a) waterplane and cross sectional area;	*	*	*	
(b) moments of area and centroid of an area;	*	*		
(c) second moments of area;	*	*		
(d) volumes and centroid of a volume.	*	*		

	A	B	C	D
b. Stability.				
13. Explain the concept of stability and define stable, unstable and neutral equilibrium.		*	*	*
14. Explain, with the aid of sketches, how the position of the centre of buoyancy, the position of the centre of gravity, the metacentric height and the righting level, affect the stability of a vessel.	*	*	*	
15. State the factors affecting the position of the centre of gravity.	*	*	*	*
16. Derive an expression for the distance of the transverse metacentre above the centre of buoyancy.	*	*	*	
17. Calculate changes in centre of gravity due to loading, discharging or moving one or more masses.	*	*	*	
18. Solve problems relating to stability for small angles of heel.	*	*		
19. Describe the procedure of the inclining experiment.	*	*	*	
20. Outline the precautions to be carried out when performing the inclining experiment.	*	*		
21. Illustrate the free surface effect on a ship's centre of gravity, when the ship heels and outline the effect of tank division on free surface effect.	*	*	*	
22. Solve problems involving free surface effect.	*	*		
23. Explain wall-sided formula and solve problems involving the wall-sided formula.	*	*		
24. Explain the "angle of loll" expression.	*	*		
25. Determine curve of statical stability from cross curves of stability.	*	*		
26. State factors affecting a curve of statical stability.	*	*	*	*
27. Solve problems on stability at large angles of heel.	*	*	*	
28. Outline methods introduced to prevent movement of bul cargoes.	*	*	*	*
29. Define dynamical stability.	*	*	*	
30. Outline the effects of wing and turning speed on dynamical stability.	*	*	*	*

	A	B	C	D
31. Calculate the forces acting on the ship's rudder when turning.	*	*	*	
32. Calculate dynamical stability of a ship.	*	*	*	
33. Define (a) longitudinal stability and (b) trim.		*	*	*
34. Solve problems involving a vessel in trim conditions.	*	*	*	
35. State and evaluate the information obtained from hydrostatic curves.	*	*	*	
36. Outline the stability problems associated with docking or ship grounding.	*	*	*	
37. Solve problems involving stability when docking.	*	*		
38. Explain (a) permeability and (b) floodable length.	*	*		
39. Outline the damage stability requirements.	*	*		
40. Estimate the waterline position when one or more ship compartments are open to sea.	*	*		
41. Calculate stability in damage condition.	*	*		
c. Structural Strength and Vibration.				
42. Describe the following conditions and state their causes: (a) hogging; (b) sagging; (c) racking and (d) pounding.	*	*	*	*
43. Illustrate bending moment and shear force stresses for a ship in still water. Explain, how the stresses change for the same ship at sea.	*	*		
44. State the forces which cause ship vibration.	*	*	*	
45. State the results of ship vibration.	*	*	*	*
d. Resistance.				
46. Define ship resistance.	*	*	*	*
47. Explain the types of ship resistance and state the factor which affect each type.	*	*	*	
48. Calculate the total resistance on a ship.	*	*		
49. State the purpose of model experiments.	*	*		
50. State Admiralty Coefficient and use it in power estimation.				
51. State the relation between speed resistance and fuel consumption.	*	*	*	*

	A	B	C	D
e. Propellers.				
52. Define terms used in propeller design.	*	*	*	*
53. Explain the following: (a) apparent slip; (b) real slip; (c) wake fraction and (d) speed of advance.	*	*	*	
54. Solve problems involving real and apparent slip.	*	*	*	
55. Explain and calculate propeller thrust.	*	*		
56. Describe propeller cavitation and state ways to eliminate cavitation.	*	*	*	
57. Describe controllabe pitch propeller and state its advantages and limitations.	*	*	*	*
58. Summarize the reasons and procedures for carrying out ship sea trials.	*	*	*	*
C. Damage Control.				
1. Identify the means and materials used to repair damages and to control leakages aboard ships.	*	*	*	*
2. State the measures to be taken and describe procedures to be followed in order to control possible leakages due to the following damages: (a) damage of outer shell in double bottoms; (b) damage of outer shell in engine room, pump room, steering gear room, cargo spaces and in fore peak and after peak tanks; (c) stern tube damage; (d) damage of main sea water suction valves; (e) damage of sea water pump and piping system and (f) damages in deep tanks, oil cargo tanks, oil storage tanks and oil piping systems.	*	*	*	*

CHAPTER XV

FIRE FIGHTING

List of Topics.

A. Chemistry and Physics of Fires.

B. Chemistry and Physics of Extinguishing Agents.

C. Fire Prevention.

D. Fire Detection.

E. Fire Extinction.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Chemistry and Physics of Fires.				
1. Define oxidation and state examples of slow and rapid oxidation.	*	*	*	
2. Define chain reaction process and explain why heat is released during the process.	*	*		
3. State the difference between fire triangle and fire tetrahedron.	*	*	*	*
4. Explain how a fire is extinguished via a fire tetrahedron.	*	*		
5. State the types of fuels and name some fuels which are common aboard ship.		*	*	*
6. Explain why vapours burn easier than solids and liquids.	*	*		
7. Explain pyrolysis process.	*			
8. State factors affecting burning rate.	*	*		
9. Define ignition temperature, flash point and fire point.	*	*		
10. Explain Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) and state their values in fire prevention.	*	*		
11. List oxidizing substances.	*			
12. Explain the effects of heat conduction, radiation and convention in fire spreading.	*	*		
13. List the hazardous products of combustion and state ways to avoid their effects when combating fire.	*	*	*	*

	A	B	C	D
14. Classify the fires according to their fuels and name the most effective and appropriate extinguishing agents for each class or combination of classes.	*	*	*	*
15. State the burning characteristics of each class of fires and explain the hazards involved during fire combating process.	*	*		
B. Chemistry and Physics of Extinguishing Agents.				
1. State extinguishing action, advantages and limitations of the following extinguishing agents:	*	*	*	*
(a) water and water types;	*	*	*	*
(b) foam;	*	*	*	*
(c) carbon dioxide (CO_2);	*	*	*	
(d) dry chemical agents;	*	*	*	
(e) dry powders;	*	*	*	
(f) halogenated agents (halon);	*	*	*	
(g) sand;		*	*	*
(h) steam.	*	*	*	*
2. State properies and application of the agents listed in question 1 (above).	*	*		
3. State advantages and list applications of steam.			*	*
4. Describe water straight and fog streams.	*	*	*	
5. Discuss high expansion foam.	*	*		
C. Fire Prevention.				
1. Appriciate the value of training in fire fighting.	*	*	*	*
2. Identify and explain the causes of fire aboard ships.	*	*	*	*
3. Explain how a crew member can contribute in fire prevention aboard ships.	*	*	*	
4. Outline the common safety measures taken aboard ships.	*	*	*	*
5. Suggest new measures for improving safety aboard ships.	*	*		

		A	B	C	D
D.	Fire Detection.				
1.	Identify the function of the following detectors and detection systems and explain their principle of operation: (a) heat actuated detectors; (b) smoke detection: (c) flame detectors; (d) manual fire alarms; (e) patrol and watchmen systems.	*	*	*	*
E.	Fire Extinction.				
1.	Recognize the importance of organization of personnel.	*	*		
2.	Identify the types of portable and semi-portable fire extinguishers and possess knowledge of the use of the following types: (a) water extinguishers; (b) carbon dioxide (CO_2) extinguishers; (c) dry chemical extinguishers; (d) dry powder extinguishers; (e) halon extinguishers.	*	*	*	*
3.	Evaluate with experience a fire situation.	*	*		
4.	Show experience in fire combating process, especially in engine rooms.	*	*	*	*
5.	Show awareness of the dangers involved in fire fighting and of the safety measures to be taken.	*	*	*	*
6.	Show experience in using breathing apparatus and protective clothing when combating a fire or offering rescue services.	*	*	*	
7.	Maintain breathing apparatus and protective clothing always available and in good condition.	*	*		
8.	Describe in detail the fixed fire fighting systems installed aboard ships.	*	*		
9.	Identify the advantages, limitations and applications of the fixed fire fighting systems and describe the hazards involved when such a system is used.	*	*		
10.	Describe the operation of the engine room fire fighting installations.	*	*	*	*

CHAPTER XVI

MARINE POLLUTION

List of Topics:

A. Effects of Marine Pollution.

B. Methods and aids.

C. Regulations.

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
A. Effects of Marine Pollution on the environment.				
1. Identify the sources of pollution of the environment.	*	*	*	*
2. Identify the size of marine pollution.	*	*		
3. State the most common pollutants of the marine environments.	*	*	*	*
4. Identify the sources of sea pollution by oil.		*	*	*
5. Explain the effects of oil and chemical used to control it on the following:	*	*	*	*
(a) plankton;	*	*	*	
(b) occlusion of light;	*			
(c) dissolved oxyzen levels;	*			
(d) fish;	*	*	*	*
(e) shellfish population;	*	*	*	*
(f) birds;	*	*	*	*
(g) turism and other human activities.	*	*	*	*
B. Methods and aids to prevent pollution of the marine environment.				
1. State the pollution prevention measures to be taken in the following cases: (a) when loading, unloading, bunkering and transfering of oils; (b)when operating oil purifier, oily separator and sewage plants; (c) when operating sludge, bilge and ballast systems.	*	*	*	*

	A	B	C	D
2. Describe the following: (a) mechanical devices for collection of oil; (b) methods and devices used to prevent spreading of oil pollution; (c) sinking, dispersing, absorbing and burning of oil; (d) methods used to clean oil on beaches.	*	*	*	*

C. Regulations.

1. Explain the purpose of the following: (a) International Oil Prevention Pollution Certificate (IOPP); (b) reception facilities; (c) segrecated ballast tanks; (d) dedicated ballast tanks; (e) retention oil on board; (f) crude oil washing; (g) oil discharge monitoring and control system; (h) special sea area.	*	*	*	*
2. List the operations which are required to be recorded in Oil Record Book.	*	*	*	*
3. Outline the conditions under which oil, or oily mixture discharge from (a) tankers and (b) cargo vessels is not prohibited.	*	*	*	
4. State the main requirements of the following: (a) regulations for the control of pollution by noxious liquid substances in bulk; (b) regulations for the prevention of pollution by harmful substances; (c) regulations for the prevention of pollution by sewage from ships.	*	*	*	*
	*	*		
	*	*	*	*

CHAPTER XVII

FUNCTIONS AND USE OF LIFE SAVING APPLIANCES

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
1. Be aware of the following: (a) types of emergency situation; (b) consequences of panic; (c) value of training and drills.	*	*	*	*
2. Identify, describe and use life saving appliances normally carried aboard ship.	*	*	*	*
3. Be aware of the location of life jackets, fire alarms and means of escape.	*	*	*	*
4. Identify the signals calling for emergency.	*	*	*	*
5. Be aware of his duties in case of emergency.	*	*	*	*
6. Explain and demonstrate the actions to be taken when called in survival craft station and when asked to abandon ship.	*	*	*	*
7. Explain and demonstrate how to enter in a craft at sea and how to assist others to enter.	*	*	*	*
8. Describe, how to right a capsized survival craft.	*	*	*	*
9. Describe the actions to be taken in the following cases: (a) fire or oil on the water; (b) cold conditions; (c) shark-infested waters.	*	*	*	*
10. Describe the actions to be taken when aboard a survival craft.	*	*	*	*
11. Describe and explain the use of the means of a survival craft.	*	*	*	*
12. Outline the actions to be taken in the following cases: (a) getting the survival craft quickly clear of the ship; (b) protection against cold or extreme heat; (c) recovering and caring for survivors; (d) facilitating detection by others; (e) remaining,as far as possible, in the vicinity.	*	*	*	*
13. Explain the dangers to survivors in a survival craft and describe the general principles for survival.	*	*	*	*

FIRST-AID AND USE OF FIRST-AID EQUIPMENT

The candidate is expected to be able to perform the following:

	Engineer Class			
	A	B	C	D
1. Explain,how an injury is determined and how the situation of the patient is evaluated.	*	*	*	*
2. Classify an injury according to its importance and its priority for treatment.	*	*	*	*
3. Explain,how he could take initiative offering in correct way emergency medical care in the following cases:				
(a) unconsciousness or respiration problems;	*	*	*	*
(b) poisoning from liquids or gases;	*	*	*	*
(c) external and internal bleeding;	*	*	*	*
(d) open and closed wounds;	*	*	*	*
(e) shocks, including electricution;	*	*	*	*
(f) burns;	*	*	*	*
(g) fractures and injuries to the bones and joints.	*	*	*	*
4. Show familiarity with the following processes:				
(a) resuscitation techniques: i. mouth to mouth; ii. mouth to nose; iii. cardiopulmonary resuscitation;	*	*	*	*
(b) application of dressings, bandages, slings and splints.	*	*	*	*
(c) carriage of injurred persons by one or more persons.	*	*	*	*

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