CINEC CAMPUS
Beyond A Graduate

PAST PAPERS

Faculty	*Department / Section/Division*
Not Applicable	*Learning Resource Centre*

Past Papers

Faculty of maritime science
Department of Marine Engineering
Engineering Class II (Ministry)
2004-2022

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

CERTIFICATE OF COMPETENCY
SECOND ENGINEER OFFICER

ENGINEERING KNOWLEDGE – II (MOTOR)

TIME ALLOWED - THREE HOURS

Attempt only SIX questions
Marks for each part of the question are shown in the brackets

Pass Mark 50% of the total marks

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

1. a) State why bed plates of large engines are fitted with chocks rather than directly on foundation plates **[4 Marks]**

   b) Sketch an arrangement of lateral choking showing the position relative to the engine **[4 Marks]**

   c) State why such an arrangement is employed **[4 Marks]**

   d) State the factors that determine the spacing of the main chocks **[4 Marks]**

2. Following a recent **turbocharger** overhaul it is observed that the scavenge air pressure is lower than it was previously and the engine power output is also reduced.

   a) State, with reasons, the possible causes of the problem. **[3 Marks]**

   b) State, with reasons, what engine operational information should be gathered in order to enable the possible cause of the problem to be detected. **[3 Marks]**

   c) Explain how the defect may be rectified. **[6 Marks]**

   d) State the instructions, which should be issued with respect to future turbocharger overhauls in order to prevent similar incidents. **[4 Marks]**

3. As a recently appointed Second Engineer you are requested to **survey** the **crosshead** of a main engine following an unscheduled repair due to bearing failure.
   a) Outline the information you would request prior to preparation for a survey. **[4 Marks]**
   b) Describe the survey procedure you would adopt stating, with reasons, the areas which should receive particularly close attention. **[6 Marks]**
   c) State, with reasons, what information you would request and the operations you would require to observe after reassembly of the crosshead **[4 Marks]**

4. Describe the means of protection against EACH of the following situations with related to the Main Engine when the engine room operating under the UMS.
   a) Crankcase explosion. **[4 Marks]**
   b) Scavenge fire. **[4 Marks]**
   c) Main Engine Turbo-Charger fire. **[4 Marks]**
   d) Loss of lubricating oil pressure. **[4 Marks]**

5. Modern day electronically controlled engines operates on the common fuel rail concept.
   a) Describe with the aid of a sketch a common rail fuel system. **[8 Marks]**
   b) Explain how the fuel pumps are operated and the common rail pressure is controlled for the common rail system described above. **[4 Marks]**
   c) Explain how the fuel injection timing and quantity is regulated. **[4 Marks]**

6. To achieve optimum main diesel engine efficiency, devices such as a mean indicated pressure (MIP) calculator, have been developed to monitor combustion and fuel system condition.
   a) Describe a system of performance monitoring of a main diesel engine using an MIP calculator. **[8 Marks]**
   b) Outline briefly how shipboard computers might be used in the main diesel engine fault-finding process. **[8 Marks]**

7. a) Briefly explain the Energy Efficiency Design Index (EEDI), Energy Efficiency operational Index (EEOI), attained Energy Efficiency Existing Ship Index (EEXI) **[6 Marks]**

   b) Explain how to measure/calculate the EEOI and EEXI of a ship **[10 Marks]**

8.

a) Sketch and describe a bottom-end arrangement employed with a vee-type trunk piston engine **[6 Marks]**

b) State the advantages and disadvantages of this arrangement compared with alternatives **[4 Marks]**

c) State why bottom-end bolts of trunk piston engines can be more susceptible to fatigue failure than those of crosshead engines and indicate how this might be minimised by good design and maintenance **[6 Marks]**

9.

a) Describe a combustion control system for an automatic package type boiler using a block-diagramme **[6 Marks]**

b) Explain how the system operates during flash-up normal running and shut down **[6 Marks]**

c) State the safety features requires for such a system **[4 Marks]**

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT-SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY
SECOND ENGINEER
ENGINEERING KNOWLEDGE-I (GENERAL)

D class 11

TIME ALLOWED-THREE HOURS
Attempt total of 10 questions as follows
SIX questions from PART A
TWO questions from PART B
TWO questions from PART C
Pass mark 50% of total marks and also need to obtain the minimum of 10 marks for each PART B & C
Answers with Clear sketchers/diagram, Neat hand writing and clear expression will get full marks.

PART A

1. With reference to centrifugal pumps:

   a) Sketch the pump characteristic curves showing head against flow, power and efficiency. **(3 Marks)**
   b) Define net positive suction head; **(1 Mark)**
   c) Explain the difference between the required and available suction head; **(3 Marks)**
   d) Describe pump cavitations, explaining how it affects the pump. **(3 Marks)**

2. With reference to a hydraulic steering gear, explain EACH of the following:

   a) The factors that may contribute to the failure of a hydraulic pipe coupling; **(3 Marks)**
   b) Why it is of the utmost importance that in the event of a hydraulic system failure that the rudder is locked and isolation of the affected area is achieved as soon as possible; **(3 Marks)**
   c) The problems that may occur when locking the rudder in heavy weather; **(2 Marks)**
   d) Explain the meant by the single failure concept. **(2 Marks)**

3. a) Sketch a Bioreactor type sewage treatment plant. **(6 Marks)**
   b) State the regulations regarding the allowable condition of the effluent discharged from this plant sketched in part **(4 Marks)**

4. a) Explain EACH of the following control terms:
   (i) cascade; **(3 Marks)**
   (ii) split range. **(3 Marks)**
   b) Describe a control system that may be enhanced by the inclusion of cascade and split range control. **(4 Marks)**

5. With reference to machinery condition monitoring systems:

   a) State what is meant by machinery condition monitoring; **(2 Marks)**
   b) State the means available for gathering data; **(2 Marks)**
   c) Describe how the data is used to indicate machinery condition trends; **(4 Marks)**
   d) Explain the relevance of machinery condition monitoring to approve planned maintenance systems. **(2 Marks)**

6. With reference to the lubrication of refrigeration compressors:

   a) State the advantage of using fully synthetic oils; **(2 Marks)**
   b) Explain why oil may be carried over from the compressor; **(3 Marks)**
   c) Describe a device which returns oil from the compressor discharge to the compressor sump; **(3 Marks)**
   d) State TWO reasons why an accumulation of oil in the evaporator is undesirable. **(2 Marks)**

7. With reference to multi-tubular heat exchangers, explain how EACH of the following contribute to satisfactory performance:

   a) Tube wall thickness; **(2 Marks)**
   b) Dense population of tubes in the tube plate; **(2 Marks)**
   c) Tube materials selection; **(2 Marks)**
   d) Coolant flow rates; **(2 Marks)**
   e) Unimpeded passage of coolant at entry and exit from the tubes. **(2 Marks)**

8. a) Explain how power is transmitted through main propulsion shafting. **(3 Marks)**
   b) State THREE operational factors that may induce high stress in shaft coupling bolts. **(3 Marks)**
   c) Sketch a hydraulic type of shaft coupling bolt. **(4 Marks)**

PART B

9. With reference to voltage variation profiles caused by load changes imposed on alternating current generators when starting large motors on line:
   a) Sketch a voltage dip, showing an acceptable recovery time; **(2 Marks)**
   b) State FOUR salient factors that cause the variation in part (a); **(4 Marks)**
   c) Outline FOUR salient factors that assist recovery from the deviation shown in part (a). **(4 Marks)**

10. With reference to a three phase electrical distribution system:
   a) discuss the advantages and disadvantages of an insulated neutral system; **(8 Marks)**
   b) state how an earthed neutral system is earthed and the measures taken to limit the maximum earth fault current. **(2 Marks)**

11. With reference to an alkaline battery cell:
   a) Describe a typical cell, stating the materials used; **(4 Marks)**
   b) Describe the electro-chemical process that takes place during discharge and charge. **(2 Marks)**
   c) State the effects of overcharge. **(2 Marks)**
   d) State the advantages of an alkaline cell compared with a lead acid cell. **(2 Marks)**

PART C

12. a) State THREE reasons for fitting transverse watertight bulkheads in ship construction. **(3 Marks)**
   b) Explain what constitutes a watertight bulkhead. **(2 Marks)**
   c) State the minimum number of transverse watertight bulkheads and their location. **(2 Marks)**
   d) Describe how watertight bulkheads are tested. **(3 Marks)**

13. a) Explain why fatigue cracks occur in a ship's hull, stating the locations where they may be found. **(3 Marks)**

   b) Describe the hull inspection that should be carried out in dry-dock to ascertain the maintenance and repairs that may need to be carried out. **(7 Marks)**

14. Describe, with the aid of sketches, how main propulsion efficiency can be improved by the addition of EACH of the following:

   a) Ducted propeller (Kort nozzle); **(5 Marks)**
   b) Vane or Grim wheel aft of the propeller. **(5 Marks)**

MINISTRY OF PORTS & SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY
SECOND ENGINEER OFFICER

ED Class I

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Attempt TEN questions only as follows:
SIX questions from Section A
TWO questions from Section B
TWO questions from Section C
Marks for each part of the question are shown in the brackets

Pass mark 50 % of total **AND** also need to obtain the minimum of **8** Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

Section A

1. As a Second Engineer of a vessel which is scheduled for a Safety equipment renewal survey. Explain a survey route listing at least 10 statutory items to be examined, the test required and information needed to facilitate the work for surveyor.

[10 Marks]

2. With reference to secondary fixed firefighting installation system in machinery space.

   a. Explain the operation such system with sketch(s). **[4 Marks]**

   b. State how to test such system for proper functionality. **[3 Marks]**

   c. State the advantages and disadvantages of this system **[3 Marks]**

3.

   a. List down the possible causes for short cycling of a refrigeration plant. **[4 Marks]**

   b. Discuss the effects of following points with related to a refrigeration system.
      i. Leakage of solenoid valve
      ii. Lack of refrigerant
      iii. Does not develop adequate discharge pressure

[Each 02 Mark]

4. An auxiliary boiler water level control has a differential pressure transmitter as the detecting element for water level.

   a. Sketch and describe such an arrangement. **[6 Marks]**
   b. If the transmitter was damaged describe how a replacement unit would be calibrated. **[4 Marks]**

5. With reference to a ship's air conditioning plant:

   a. Define the term comfort zone; **[2 Marks]**
   b. State the objectives of maintaining the conditioned air within the comfort zone; **[2 Marks]**
   c. State, with reasons, FIVE areas from which the conditioned air must not be recirculated. **[3 Marks]**
   d. With related to overhaul of an AC compressor, discuss a proper procedure to be followed during recovery and recharge process of the refrigerant. **[3 Marks]**

6.

   a.
      i. Sketch a simple line diagram showing a shipboard two stage oil-water separator. **[3 Marks]**
      ii. Describe the arrangement and operation of the separator sketched in Q. 6 a. i. **[3 Marks]**
   b. State MARPOL requirements, pertaining to pumping out of machinery space bilges. **[2 Marks]**
   c. State MARPOL requirement, pertaining to pumping out of oil cargo residues. **[2 Marks]**

7. With reference to an emergency generator discuss following including legislative requirements.

   a. Starting arrangements, **[2 Marks]**
   b. Cooling systems, **[2 Marks]**
   c. Fuel and its supply, **[2 Marks]**
   d. Periodic attention required, **[2 Marks]**
   e. Location. **[2 Marks]**

8. With reference to intermediate bearing,

   a. Describe a method of hydraulic jacking to check bearing loads **[5 Marks]**

   b. Comment on the suitability of EACH of the following Courses of action in the event of an overheated transmission shaft bearing:

i. Reduce the ship's speed; [1 Mark]
ii. Cool with a fire hose; [1 Mark]
iii. Change lubricating oil; [1 Mark]
iv. Adjust height of bearing; [1 Mark]
v. Adjust height of adjacent bearing. [1 Mark]

Section B

9.

a. Explain why it is necessary to have reverse power protection for alternators intended for parallel operation. [3 Marks]
b. Sketch a reverse power relay trip. [3 Marks]
c. Explain principle on which the operation of the relay trip is based, describing how tripping is activated. [2 Marks]
d. State the typical set values of reverse power tripping for,
   i. Diesel driven alternators [1 Marks]
   ii. Turbo alternators [1 Marks]

10. With reference to the electrical propulsion for passenger ships,

a. Outline the advantages of choosing the electrical propulsion system. [3 Marks]

b. Sketch and briefly explain the following.

   i. Cyclo-converter. [4 Marks]
   ii. Synchrodrive. [3 Marks]

11.

With reference to the operation of governors fitted to diesel alternators that generally operate in parallel:

a. Explain why an isochronous characteristic is undesirable. [4 Marks]
b. State what is meant by droop & give an analogy of droop in control engineering terms [3 Marks]
c. Sketch & describe a load/frequency diagram showing how two generators share the electrical load [3 Marks]

Section C

12. With reference to rudder carrier bearings,

    a. Sketch and describe such a bearing. **[8 Marks]**
    b. State how adjustment is made to compensate for wear down. **[2 Marks]**

13.

    a. Explain the routine steps for surface preparation and painting of hull under water area of an existing ship in dry dock your answer should include the reason for each activity **[6 Marks]**
    b. State the regulatory requirements to be satisfied in under water coatings **[2 Marks]**
    c. Discuss the advantages and Disadvantages of using Foul Release coatings as a method of prevention of fouling in under water areas. **[2 Marks]**

14. Describe EACH of the following, stating what component parts of the ships structure helps to resist the following effect.

    a. Racking **[2 Marks]**
    b. water pressure effect **[2 Marks]**
    c. Panting **[2 Marks]**
    d. Pounding **[2 Marks]**
    e. Dry docking stresses **[2 Marks]**

MINISTRY OF PORTS & SHIPPING AND SOUTHERN DEVELOPMENT

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY
SECOND ENGINEER OFFICER

ED Class II

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Attempt TEN questions only as follows:
SIX questions from Section A
TWO questions from Section B
TWO questions from Section C
Marks for each part of the question are shown in the brackets

Pass mark 50 % of total AND also need to obtain the minimum of **8** Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

Section A

1. With reference to "ISM Code" write short notes on
   a. Masters Responsibility and Authority **[2 Marks]**
   b. Advantage of drills and exercises **[2 Marks]**
   c. Internal Audits **[2 Marks]**
   d. Management Review **[2 Marks]**
   e. Non conformities **[2 Marks]**

2.
   a. With respect to the steering gear, answer the following: A. Explain with a diagram, a "fail safe steering gear" suitable for use on a tanker of more than 100000 T dwt; **[6 Marks]**

   b. Explain the sequence of events that take place when an oil leak takes place in one of the hydraulic pipe lines. **[4 Marks]**

3.
   a. With reference to tanks containing hydrocarbon liquids and vapors: define EACH of the following terms:
      i. Explosive limits; **[2 Marks]**
      ii. Vapor pressure; **[2 Marks]**
      iii. Flash point. **[2 Marks]**

b. Explain how the atmosphere in cargo tanks containing varying percentages of flammable gas can be maintained in a safe condition at all times. **[4 Marks]**

4.

a. Sketch and describe a rudder quadrant and tiller. **[4 Marks]**
b. Explain the method that they fastened to the rudder post **[2 Marks]**
c. What provisions are made to take up the shock from heavy seas **[2 Marks]**
d. Discuss is the sealing arrangement for passing the rudder stock through the ship's hull **[2 Marks]**

5. With reference to entry into enclosed spaces:

a. Describe the hazards that may be encountered; **[3 Marks]**
b. State where guidance can be obtained. **[2 Marks]**
c. Sketch and describe an oxygen analyzer. **[5 Marks]**

6. With reference to oil monitoring of bilge and tanker ballast discharges:

a. Describe with the aid of a sketch, the general arrangements of an oil monitoring system; **[6 Marks]**
b. State the inputs that are recorded; **[2 Marks]**
c. Explain the difficulties encountered with the efficient operation of the oil monitoring. **[2 Marks]**

7. An auxiliary boiler water level control has a differential pressure transmitter as the detecting element for water level.

a. Sketch and describe such an arrangement. **[6 Marks]**
b. If the transmitter was damaged describe how a replacement unit would be calibrated. **[4 Marks]**

8. With reference to a ship's air conditioning plant:

a. define the term comfort zone; **[3 Marks]**
b. state the objectives of maintaining the conditioned air within the comfort zone; **[3 Marks]**
c. State, with reasons, FIVE areas from which the conditioned air must not be recirculated. **[4 Marks]**

Section B

9. With regards to generator excitation system.

   d. Explain how loss of excitation detected and handle. **[4 Marks]**
   e. Sketch and describe excitation system suitable for ships emergency generator plant. **[6 Marks]**

10.

   a. Sketch a circuit diagram of a push button direct on line contactor starter, incorporating overload short circuit protection. **[4 Marks]**
   b. Indicate, on a sketch of the typical characteristics curves of a current torque against speed, the disadvantages of a direct on line start squirrel cage induction motor **[6 Marks]**

11.

   a. Explain why a 3 phase synchronous motor is not self-starting **[2 Marks]**
   b. Draw a schematic diagram of an electric drive system powered by a 3 phase synchronous induction motor **[2 Marks]**

   c. With reference to Q11. a explain how EACH of the following is achieved
      i. Starting **[1 Marks]**
      ii. Speed control **[1 Marks]**
      iii. Reversal of rotation **[1 Marks]**
      iv. State the advantages obtained when a 3 phase synchronous motor operates at unity power factor **[3 Marks]**

Section C

12. With reference to dry docking of a vessel

   a. How the vessel is planned and prepared for dry docking **[3 Marks]**
   b. State the pre docking information and drawings given to dry dock authority **[3 Marks]**
   c. Describe the Extent of survey/items to be examined and repairs carried out in dry dock taking the advantage of dry dock occupation **[4 Marks]**

13.

a. Sketch the forward construction of a ship **[6 Marks]**

b. Explain the term "Pounding", discussing the arrangements made to resist "Pounding" **[2 Marks]**

c. What are the advantages and disadvantages of a bulbous bow. **[2 Marks]**

14.

With reference to membrane tanks for the carriage of liquefied gas at very low temperatures:

a. Describe with the aid of a sketch ONE method of building up the insulation; **[2 Marks]**

b. State with reasons the alloy, which is used for the membrane. **[2 Marks]**

c. Describe with the aid of a sketch how the tanks are located and supported:

   i. Longitudinally;

   ii. Transversely.

[6 Marks]

Class II E/D

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY
SECOND ENGINEER OFFICER – OCTOBER 2018

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Attempt SIX questions only as follows:
SIX questions from Section A
TWO questions from Section B
TWO questions from Section C
Marks for each part of the question are shown in the brackets

Pass mark 50 % of total **AND** also need to obtain the minimum of **8** Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

Section A

1. Sketch a sealing arrangement for an oil lubricated stern tube - and [4 Marks]
   a) Identify the common forms of seal failures [2 Marks]
   b) State how oil loss due to seal failures can be restricted whilst on passage [2 Marks]
   c) State the purpose of materials which are used for sealing rings and chrome liner [2 Marks]

2. With reference to pumping and system
   a) Sketch a double acting reciprocating pump, labeling the component parts [4 Marks]
   b) Compare the theoretical performance for above pump with a performance of centrifugal pump [2 Marks]
   c) State how pressure fluctuations are dampened [1 Mark]
   d) State, with reasons, the duties that the pump sketched in part (a) is particularly suited [3 Marks]

3. When on deep sea passage, as Second Engineer Officer, on entering the engine room you are met with the following scenarios,
   A strong smell of sewage effluent, sewage treatment plant showing high level alarm, sewage discharge pump running but amperes reading low and aft bilge well in high alarm, State the actions to be taken and maintenance required to restore the plant to correct working order [10 Marks]

4. With reference to elector hydraulic steering gear-system
   a) Describe the "single failure" criteria with aid of sketch/of a steering gear with 50% torque unit [5 Marks]

   b) State with reasons the precautions necessary when operating on two rams only [2 Marks]

   c) Describe the test necessary to ascertain that the steering gear will operate as required when one side of the circuit develops a malfunction [3 Marks]

5. With reference to inert gas system in a crude oil tanker
   a) Sketch a cargo space inert gas system with all the safety fittings that uses washed and cooled gas from a boiler [5 Marks]
   b) List five (5) safety features built in the inert gas system, stating the function of EACH [5 Marks]

6. All the ships which are undergoing an international and the coastal water trading will be subjected to series of survey by the administration or the recognized organization on behalf the administration
   a) Explain the reason(s) to have such a survey on board a ship [3 Marks]
   b) Explain the surveys under taken by classification societies and the frequency of all surveys including machinery survey [4 Marks]
   c) Explain the scope of each surveys [3 Marks]

7. a) Discussed the procedures for under taking hot work onboard the ship
      i. Pre-use equipment test [2 Marks]
      ii. Precautions against fire and explosion [2 Marks]
      iii. Precautions during use of electric arc welding [2 Marks]
      iv. Gas welding and cutting [2 Marks]

   b) Explain the procedure for identifying welding defects on a welding seam [2 Marks]

8. a) Sketch a hydraulically tensioned shaft coupling bolt which incorporates a tapered sleeve fitted between the bolt and the coupling holes [4 Marks]

   b) Describe how the bolt assembly sketched in part (a) is fitted [3 Marks]

   c) State the advantages of this type of arrangement compared to conventional bolt assemblies [3 Marks]

Section B

9. With reference to High Voltage electric (a.c.) equipment

a) What is mean by ***polarization index*** and explain the requirement to take such kind of measurement [2 Marks]

b) Explain the type of personnel utilized for carried out maintenance on above motors [2 Marks]

c) State the type of fuse(s) that are fitted and how it prevents single phasing [2 Marks]

d) Describe the operation of EACH of the following direct temperature sensors:

i. Resistance temperature device [2 Marks]
ii. Thermistor [2 Marks]

10. a) Sketch a circuit that allows both trickle charging and fast charging of lead-acid batteries [3 Marks]

(b) State, with reasons, why trickle charge and fast charge provision are necessary [1 Mark]

(c) Explain why lead-acid batteries may have to be taken off charge in hot climates [2 Marks]

d) Discussed the parameters that can be used to assess the proper charging of a lead acid and alkaline battery [2 Marks]

e) list out four reasons of reducing the rated capacity of a battery [2 Marks]

11. a) Describe, with the aid of a sketch, the constructional details of a squirrel cage rotor as fitted in an induction motor [4 Marks]

b) Explain why some rotors have a double cage [3 Marks]

c) Draw a suitable speed control electrical circuit diagram for the windlass operation [3 Marks]

Dilum

Section C

12. With reference to effect of flooding on transverse stability and trim,
    a) Explain what is meant by "floodable length" [2 Marks]
    b) Explain the significance of the factor of subdivision [2 Marks]
    c) Explain why the bilging of empty double-bottom tanks or deep tanks that are wholly below the water line leads to an increasing in GM [3 Marks]
    d) Draw a typical floors for the construction of a double bottom tank [3 Marks]

13. a) When the ships are carried to Dry-Docking
        i. Explain why the GM must remain positive until the critical instant at which the ship takes the block overall [2 Marks]
        ii. Discussed how stern frame has been constructed for sustaining the up thrust at the stern [3 Marks]
    b) Describe the design and method of construction of Bilge keel to ship hull for reducing damaged to ship hull [2 Marks]
    c) Explain why bilge keel is not extended for the entire length of ship [3 Marks]

14. With reference to ship's lifeboats
    a) Sketch a typical main brake [5 Marks]
    b) State the safety features incorporated in the brake should the operator:
        i. let go of the brake handle completely during lowering [1 Mark]
        ii. attempt to lower the lifeboat too quickly [1 Mark]
    c) State the maximum rate of descent when launching [1 Mark]
    d) Explain how the lifeboat is protected from falling back into the water if the power fails when hoisting the boat [2 Marks]

E/D class II

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY
SECOND ENGINEER OFFICER

ENGINEERING KNOWLEDGE – II (MOTOR) – OCTORBER 2018

TIME ALLOWED - THREE HOURS

Attempt SIX questions only:

Marks for each part of the questions are shown in the brackets

Pass mark 50 %

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

1. With reference to the Main Engine Turbo Chargers

   a) State the types of bearings are used [2 Marks]
   b) State with reasons damaged occurred above bearings [4 Marks]
   c) Explain the bearing replacement procedure of any one of above type [6 Marks]
   d) Describe with the aid of sketches the procedure adopt to check the turbo charger clearances/ Measurements of type mentioned in Q1(c) and importance of each clearances and measurements. [4 Marks]

2. a) Discuses the following, refer to the risk assessment practice and their use on board ship

   i. Element of the risk assessment [3 Marks]
   ii. Identify hazards [2 Marks]
   iii. Identify risk control [3 Marks]
   iv. Estimate Risk [2 Marks]
   v. Determine tolerability of risk [3 Marks]

   b) Explain the procedure for carrying out fuel valve function test procedure for a electronically control large bore cross head type diesel engine [3 Marks]

3. a) As a second Engineer, you have been requested to obtain a set of indicator cards from the Main Engine (large slow speed diesel engine) of a recently acquired seven years old vessel

   i. Describe your initial checks and preparations for above task [4 Marks]
   ii. State, with reasons, the type of cards you would consider necessary and explain the procedures for obtaining of those cards [3 Marks]
   iii. State, the additional information required with the cards [3 Marks]
   iv. State how would you obtain the engine power [3 Marks]

   b) Compare with modern engine the vary of assessing the power [3 Marks]

4. a) Describe with labeled diagram to indicate major components in a typical manoevering and reversing system including blocking devices and safety cut outs of a large bore cross head type diesel engine [8 Marks]

   b) State the kind of failures that may be occurred in above system and procedure for rectifying [3 Marks]

   c) Describe how to perform **emergency** maneuvering in the event of failure in above control system [5 Marks]

5. Maintaining a healthy engine cooling water system for the diesel engine is essential
   a) State the problem(s) which may arise in above system [3 Marks]
   b) Evaluate the common methods of diesel engine cooling water treatment [3 Marks]
   c) Discussed new development(s) of cooling systems with examples [4 Marks]
   d) Itemize the sources and type of contamination of diesel engine cooling water and explain the effect of these contamination [6 Marks]

6. Reference to propulsion characteristic of a diesel engine plant
   a) Explain the following with a aid of sketch(s) [6 Marks]
      i. Continuous service rating
      ii. Engine margin
      iii. Constant speed line
      iv. Limits for the continuous operation

   b) Explain how do you adjust SFOC for lower calorific value of fuel from ISO 8217:2012 reference [6 Marks]
   c) Explain the procedure for testing correct fuel injection timing for a large bore cross head type two stoke diesel engine [4 Marks]

7. a) sketches a suitable boiler safety valve for the boiler ~~whose~~ Which Maximum working pressure is 10 bar [4 Marks]

b) Describe the overhaul procedure of above safety valve its parts which are required particular attention [6 Marks]

c) Describe the setting of exhaust gas boiler safety valve to comply with Classification society requirement [6 Marks]

8. With reference to ships machinery vibration

a) Explain the term ***torsional vibration***, indicating the effect this can have on an engine crank shaft [8 Marks]

b) Explain why a detuner/ vibration damper might be fitted to an engine. [4 Marks]

c) Explain why an engine might have a barred speed range and why the engine should not be operated continuously in that range. [4 Marks]

9. If a main engine piston seizes in its liner at sea and it is not possible to carry out necessary repairs, as Second Engineer what action need to be taken to enable the ship to reach next port safely. [16 Marks]

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY

SECOND ENGINEER OFFICER

ENGINEERING KNOWLEDGE – II (MOTOR) - FEBRUARY 2017

TIME ALLOWED - THREE HOURS

Attempt SIX questions only:
Marks for each part question are shown in brackets

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

1. *"A small crack in a high-pressure oil fuel pipe may lead to a most dangerous situation"*

a) Give your opinion/s on above statement with facts. **[3 Marks]**

b) According to the SOLAS requirements to break the fire triangle chain;

i) State how does FLAMMABLE OIL can be controlled in the Engine room **[5 Marks]**

ii) State how does IGNITION/HEAT SOURCE can be controlled in the engine room **[4 Marks]**

c) State what factors that need to be considered when using the Flexible pipes, hoses and hose assemblies in the flammable oil lines **[4 Marks]**

2 As Second Engineer, you have been requested to obtain a set of indicator cards from the large slow speed engine of a recently acquired old vessel.

a) Describe your initial checks and preparations. **[6 Marks]**

b) State, with reasons, the types of cards you would consider necessary and explain the procedures for obtaining these. **[4 Marks]**

c) State, in order of **importance**, the additional information required with the cards. **[3 Marks]**

d) State your procedure for analysis of the cards and obtaining cylinder powers. **[3 Marks]**

3. The main engine normally burns fuel with properties given in column I of Table below; but fuel with properties given in column II has been bunkered and must be used.

a) Comment on the possible problems with respect to EACH of the EIGHT fuel properties **[12 Marks]**

b) Explain how you would manage to use this bunker oil as Second Engineer, ensuring the satisfactory engine operation. **[4 Marks]**

Property	Column I	Column II
Viscosity (cst/50 degree C)	250	380
Flash point (degree C)	75	90
Conradson Carbon (% wt)	12	22
Pour Point (degree C)	30	40
Sulphur (% wt)	2.5	3.5
Water (% wt)	0.5	1.3
Vanadium (ppm)	120	550
Sodium (ppm)	20	150

4. a) Sketch and describe a system of control for maneuvering a main diesel engine from the bridge in a direct drive fix pitch propulsion system. **[8 Marks]**

b) State the kind of emergency situations that local control may be required to use **[3 Marks]**

c) Explain how local control may be used safely in case of emergency. **[5 Marks]**

5. a) Describe the actions and checks required to ensure that a crosshead main propulsion engine may be operated in a Slow Steaming condition. **[8 Marks]**

b) Explain the problems which may arise during a prolonged period of Slow Steaming. **[4 Marks]**

(c) Explain what actions should be taken before and after the engine is returned to normal operation after a period of Slow Steaming. **[4 Marks]**

6. As Second Engineer Officer outline a safe procedure for the changing of a cylinder liner in a Slow Speed marine diesel engine from the removal of the cylinder cover to the replacement of the liner having appropriate inspections and taking necessary readings/calibrations. **[16 Marks]**

7. a) Describe, with the aid of a sketch, one throw of a *semi-built* crankshaft for a large slow speed engine, explaining the advantages of this method of construction. **[5 Marks]**

b) Explain how lubrication of the crankshaft bearings is achieved. **[4 Marks]**

c) Describe the wear pattern of the Crank Pin with reasons **[4 Marks]**

d) Explain how wear down on the crankpin can be measured. **[3 Marks]**

8. With reference to the dual-Fuel two stroke engines used in LNG Carriers

a) State the advantages of these engines **[3 Marks]**

b) Describe with the aid of sketches the operation of both pilot fuel and gas fuel injection into the combustion chamber **[8 Marks]**

c) Explain the safety features incorporated in the gas piping system **[5 Marks]**

9. With reference to auxiliary boilers:

a) State the effects of a persistently leaking safety valve on EACH of the following:

(i) The feed system; **[1 Mark]**

(ii) The valve itself. **[3 Marks]**

b) Explain the actions necessary to correct a leaking safety valve whilst at sea. **[6 Marks]**

c) Describe the preparation of boiler for an internal boiler survey **[6 Marks]**

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATION OF SECOND ENGINEER OFFICERS IN A MANNED ENGINE-ROOM OR AS DESIGNATED DUTY ENGINEERS IN A PERIODICALLY UNMANNED ENGINE-ROOM OF A SEA GOING SHIP OF MAIN PROPULSION POWER OF 3000 KW OR MORE– OCTOBER 2016

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS
Answer **TEN** questions.
Answers with clear sketches/diagrams,
Neat handwriting and clear expression will get full marks.

SECTION A- Answer any **SIX** questions

1. Materials used for hull and machinery are subjected to stress and strain in service

   a) Describe THREE types of stress and TWO types of strain **[5 Marks]**
   b) Describe the safe procedure to carry-out an inspection of a fuel oil double bottom tank stating that the items are to be inspected. **[5 Marks]**

2. With reference to Lifeboat release and retrieval systems

   a) Summarize the new IMO requirements **[5 Marks]**
   b) Describe the routine maintenance and inspections on Life-Boat and its associated equipment. **[5 Marks]**

3. With reference to ***Training On-Board Ships***

   a) Explain the purpose and impotency of On-Board Training **[3 Marks]**
   b) List the areas in which training is required and areas in which it is desirable. **[3 Marks]**
   c) Describe the preparation needed before start of a training session and the way to conduct a training session **[4 Marks]**

4. With reference to Marine Pollution Control by Construction

   a) Sketch and Explain a Crude Oil Washing (COW) System **[5 Marks]**
   b) State the advantage and disadvantage of COW **[5 Marks]**

5. With reference to the controllers

   a) Describe with aid of sketches the principle of FOXBORO pneumatic controller and procedure to adjust it to give variation to the proportional band **[5 Marks]**

   b) Explain the routine tests and maintenance procedure of the above controller **[5 Marks]**

6. With reference to Ship's air conditioning plants

a) Define the term " *Comfort Zone*" stating that the objectives of maintaining the conditioned air within the *Comfort Zone* **[5 Marks]**

b) Describe with aid of a PSYCHROMETRIC CHART how the accommodation is maintained at comfort level assuming no recirculation of air when ambient conditions are 35 °C and 50% relative humidity. **[5 Marks]**

7. With reference to Ship's Deck Machineries

a) Sketch a line diagram showing the layout and components of a hydraulic system with a variable delivery, pressure compensated pump and accumulator, suitable for the operation of deck machinery. **[5 Marks]**

b) Describe the inspections and routine maintenances are to be carried-out on an electro-hydraulic deck crane. **[5 Marks]**

8. With reference to Evaporators

a) Explain how scale formation is taking place **[5 Marks]**

b) Describe the principle methods used to reduce scale deposits in evaporators **[5 Marks]**

SECTION B – Answer any TWO questions (minimum of 10 marks required)

09. With regards to high voltage motor used for bow thruster.

a) Explain in detail the procedure for testing the insulation resistance of the electric motor. **[5 Marks]**

b) State an acceptable insulation resistance value for above mention motor. **[2 Marks]**

c) Write the steps to be taken if the insulation resistance value found not within the range to bring back to acceptable value. **[3 Marks]**

10. Explain what is mean by and the significance of the following terms.

a) Armature reaction. **[2 Marks]**

b) Silicon Control Rectifier. **[2 Marks]**

c) Voltage stabilization. **[2 Marks]**

d) Grid bias voltage. **[2 Marks]**

e) Harmonic filters. **[2 Marks]**

11. With regards to impressed current control system

a) Describe with aid of sketches a typical impressed current control system **[6 Marks]**

b) Explain the inspections and safety precautions are to be taken during ships operation. **[4 Marks]**

SECTION C– Answer any **TWO** questions (minimum of **10 marks** required)

12. a) Describe with the aid of a sketch, how a hydraulically operated folding hatch cover opens and closes. **[7 Marks]**

b) Explain how the water tightness and security of the hatch cover sketched in above can be achieved before proceeding to the sea. **[3 Marks]**

13.a) Explain the reasons for introducing regulations to control a vessel's discharge of ballast water **[4 Marks]**

b) Describe THREE methods of complying with the regulations for the discharge of ballast water taken on board from distant waters. **[6 Marks]**

14.a) Define the *propeller Slip* **[3 Marks]**

b) State with reasons FOUR conditions which will affect the propeller slip **[7 Marks]**

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT - SRI LANKA

EXAMINATION FOR CERTIFICATION OF SECOND ENGINEER OFFICERS IN A MANNED ENGINE-ROOM OR AS DESIGNATED DUTY ENGINEERS IN A PERIODICALLY UNMANNED ENGINE-ROOM OF A SEA GOING SHIP OF MAIN PROPULSION POWER OF 3000 KW OR MORE– OCTOBER 2016

ENGINEERING KNOWLEDGE – II (MOTOR)

TIME ALLOWED - THREE HOURS
Answer **SIX** questions.
Answers with clear sketches/diagrams
Neat handwriting and clear expression will get full marks.

---

1. With reference to the Engine performance
   a) Sketches the graphs showing how brake thermal efficiency, fuel consumption and specific fuel consumption vary as engine power increases from zero to approximately 20% above the rated power. **[4 Marks]**
   b) Explain FOUR Safety Margins for engine operation with aid of a Load range diagram **[12 Marks]**

2. With reference to the MAN B&W ME Engines
   a) Describe the Engine Control System using a block diagram **[6 Marks]**
   b) Explain the safe Dismantling and Mounting procedure of a Multi-Purpose Controller(MPC) board **[10 Marks]**

3. With reference to the SULZUR RT flex Engines
   a) "Injection quantity piston, stuck in max. position"
      i. State the reasons for above (a) **[4 Marks]**
      ii. Explain how do you rectify above problem **[8 Marks]**
   b) With regard to the ***Injection Control Unit***
      i. Explain the *Wear Recognition Procedure* on the Injection Control Unit giving examples of *Injection Curves* **[4 Marks]**

4. With reference to the *Energy Efficiency Regulations*

a) Examine the new technical inventions can be used to increase the Energy Efficiency **[8 Marks]**

b) Explain the actions/methodologies which can be taken on-board to increase the Energy Efficiency **[8 Marks]**

5. With reference to the FUEL used on-board the Vessels

a) Explain the ignition quality of a fuel CCAI and state categorization of fuel as bad quality according to the CCAI. **[4 Marks]**

b) Describe the harmful effect of Sulphur Trioxide in the product of combustion **[4 Marks]**

c) Explain the part that Nitrogen takes in the combustion process **[4 Marks]**

d) Explain SCR method used on-board the vessels to reduce the NOx emission. **[4 Marks]**

6. **"To prolong the operating life of gear wheels, regular inspections and maintenance is essential";** With reference to this statement

a) State the Items are to be inspected on gearing mechanisms **[4 Marks]**

b) Describes how to perform on-site gear inspection using necessary equipment and techniques **[12 Marks]**

7. With reference to the Main Engine Turbo-Chargers

a) Discuss the possible failures and defects which can be occur during the operation **[6 Marks]**

b) Describe the operation of Main Engine under above mentioned each failures and defects **[10 Marks]**

8. With reference to the packaged type boilers

a) Explain the principle features of a packaged boiler **[8 Marks]**

b) Describe the safety features fitted **[8 Marks]**

9. With reference to the bottom end bearings of Slow Speed Diesel Engines

a) Describe a procedure for checking the clearance of a diesel engine bottom end bearing. **[6 Marks]**

b) Explain the possible consequences of operating an engine with excessive bottom end bearing clearances. **[4 Marks]**

c) Describe a procedure for restoring an excessive bottom end clearance to its correct value. **[6 Marks]**

27 - 31 ETO AM
May - ETR/ETO PM

DEMORATIC SOCIALIST REPUBLIC OF SRI LANKA

MINISTRY OF PORTS AND SHIPPING

MERCHANT SHIPPING SECRETARIAT

EXAMINATION FOR CERTIFICATION OF SECOND ENGINEER OFFICERS IN CHARGE OF AN ENGINEERING WATCH IN A MANNED ENGINE-ROOM OR AS DESIGNATED DUTY ENGINEERS IN A PERIODICALLY UNMANNED ENGINE-ROOM OF A SEA GOING SHIP OF MAIN PROPULSION POWER OF 3000 KW OR MORE (MOTOR) – JANUARY 2016

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

SECTION A- Answer any SIX questions

1. With regards to auxiliary boiler control system.
   a. Using a block diagram describe the basic operation of a burner control system for an auxiliary boiler during flash up only. **[6 Marks]**
   b. State how items in the system safely tested. **[4 Marks]**

2. With regards to oil lubricated stern tube bearing
   a. Sketch a sealing arrangement and identify the common forms of seals failure **[4 Marks]**
   b. State how oil loss due to seal failure can be restricted whilst on passage. **[4 Marks]**
   c. What material used for sealing ring and propeller shaft liner. **[2 Marks]**

3. With reference to ram type steering gear systems,
   a. Sketch and briefly describe the ram sealing arrangement. **[3 Marks]**
   b. Describe the replacement procedure of seals in-case of oil leak from the particular ram. **[3 Marks]**
   c. State TWO methods of locking the rudder. **[4 Marks]**

4. Explain the action of the EACH of the followings metallurgical mechanisms.
   a. Creep. **[2 Marks]**
   b. Brinelling. **[2 Marks]**
   c. Fretting corrosion. **[2 Marks]**
   d. State with reasons where EACH of the above may occur in the ship propulsion system. **[4 Marks]**

5. You are the Second Engineer of a vessel subjected to an annual survey soon. For the fire appliances in a vessel of your choice plan a survey route listing the statutory items to be examined, the test required and information needed to facilitate the work for surveyor. **[10 Marks]**

6. In fresh water generator the brine density should be prevented from falling below a particular value to minimize one or combination of the following.
   a. Scale formation on the heat exchanger. **[4 Marks]**
   b. Loss in capacity and economy. **[3 Marks]**
   c. Corrosion in the evaporator. **[3 Marks]**

7. Define with reasons, the conditions which determine whether an oil centrifuge functions as either a purifier or a clarifier.
   a. Identify the factors determining the extent to which suspended solids are extracted from the oil. **[4 Marks]**
   b. State what effect clutch slip and bowl dirtiness has upon oil conditioning. **[4 Marks]**

8. With reference to oil monitoring of bilge and tanker ballast system.
   a. Describe with the aid of a sketch the general arrangement of an oil monitoring system. **[6 Marks]**
   b. State the inputs that are recorded. **[2 Marks]**
   c. Explain the difficulties encountered with the efficient operation of the oil monitoring system. **[2 Marks]**

9.20

SECTION B – Answer any TWO questions (minimum of 8marks required) (12)

9. With reference to the protection of electric motors explain EACH of the followings.
   a. Fuse back up protection. **[3 Marks]**
   b. How a motor fitted with fuse back up protection may exceed its rated temperature without being tripped by its primary protection system. **[4 Marks]**
   c. A means for protection for a motor to safeguard the rated temperature being exceed. **[3 Marks]**

10. With reference to shipboard automatic fire detection systems.
   a. Sketch an alarm control panel which operates on 24V DC showing the various circuits that are connected to it. **[3 Marks]**
   b. Describe the operation of the above system and state what will happen in the event of main power failure. **[4 Marks]**
   c. Explain how the fault alarm actuating circuit for detecting faults in the cables or detectors work. **[3 Marks]**

11. Explain what is mean by and the significance of the following terms with regards to high voltage electrical distribution system.
   a. Dead front switch board. **[4 Marks]**
   b. Harmonic filters. **[3 Marks]**
   c. Vacuum breakers. **[3 Marks]**

SECTION C – Answer any TWO questions (minimum of 8marks required)

12. Describe the possible faults which may be found during a dry dock inspection of the following.
    a. Stern frame. **[2 Marks]**
    b. Sea chest. **[2 Marks]**
    c. Bilge keel. **[2 Marks]**
    d. Anodes. **[2 Marks]**
    e. Rudder. **[2 Marks]**

13.
    a. State the difference between a water tight door and a weather tight door. **[2 Marks]**
    b. Sketch and describe a water tight door and its operating mechanism. **[6 Marks]**
    c. State FOUR circumstances under which all water tight doors must be closed when circumstances are define as potentially hazardous. **[2 Marks]**

Departure in the port. Shallow waters Entering in dock port Heavy weather condition Piret ~~cases~~

14. Explain EACH of the following with regards to thickness measurements and acceptance criteria.
    a. Gauged thickness. **[2 Marks]**
    b. Reserve thickness. **[2 Marks]**
    c. Renewal thickness. **[2 Marks]**
    d. Voluntary thickness addition. **[2 Marks]**
    e. Substantial corrosion. **[2 Marks]**

V 2013

MINISTRY OF PORTS & HIGHWAYS

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING -SRI LANKA

EXAMINATOIN FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER UNLIMITED – OCTOBER 2013

ENGINEERING KNOWLEDGE – II (MOTOR)

TIME ALLOWED - THREE HOURS

Answer any SIX questions .

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

1.

a. Explain the steps to be taken and changeover procedure to ensure that the vessel which is normally operates on HSFO, safely enter Californian ARB Regulatory (RCW) area. **[10 Marks]**

b. Explain the possible consequences on the engine if the cylinder oil used in above area has a base number suited to HFO with high Sulphur content. **[6 Marks]**

2.

a. During a sea passage main bearing high temperature alarm activated in one of the Main Engine unit, as a Second Engineer state your action with regards to safety of the engine. **[6 Marks]**

b. Identify TWO main causes to activate above alarm. **[2 Marks]**

c. Describe in detail, procedure for opening and inspection of bottom half of the above mention bearing. **[8 Marks]**

3.

a. Explain the term Variable Injection Timing (VIT) which applied to fuel pumps and state why a change in timing of fuel injection may be required. **[4 Marks]**

b. Describe with the aid of sketch, a VIT fuel pump and explain how the change in timing is achieved while the pump in operation. **[6Marks]**

c. Explain how it may be determined that individual fuel pumps are injecting the correct quantity of fuel with the correct timing at a particular pump setting. **[6 Marks]**

4. With reference to electronically controlled engines.
   a. Sketch a starting air system with slow turning function and explain how the slow turning initiates. **[8 Marks]**
   b. Describe how the simultaneous injection of fuel and starting air is prevented in the system sketched above. **[6 Marks]**
   c. State TWO safety devices fitted to the system with function. **[2 Marks]**

5. Modern day electronically controlled engines can be operates on very low rpm.
   a. Describe in detail most common methods used to achieve this. **[8 Marks]**
   b. Explain advantages and disadvantages of running the engine with very low rpm for prolonged time period. **[8 Marks]**

6.
   a. Describe with the aid of a sketch exhaust valve which is hydraulically open and pneumatically closed, used in modern two stroke engine. **[8 Marks]**
   b. Write an overhaul report for the above valve stating necessary measurements and clearances. **[8 Marks]**

7. Discuss the validity of EACH of the following statements with respect to diesel engine.
   a. Modern materials permit increase of power without the limitations formerly imposed on exhaust temperature. **[4 Marks]**
   b. Pistons are subjected to high stresses which engine makers need additional measures. **[4 Marks]**
   c. Diesel engine crank case oil can safely be used for air compressor lubrication. **[4 Marks]**
   d. Cylinder lubrication in terms of quality and quantity can influence wear. **[4 Marks]**

8. With reference to main engine turbochargers explain the construction and the purpose of EACH of the followings.
   a. Labyrinth seals. **[4 Marks]**
   b. Nozzle ring. **[4 Marks]**
   c. Diffuser. **[4 Marks]**
   d. Turbine blades. **[4 Marks]**

9. With reference to Main Engine camshaft chain drives.
   a. Describe why the correct tension is required. **[4 Marks]**
   b. State how correct tension is checked and adjusted. **[6 Marks]**
   c. Describe the procedure for inspecting a chain drive system stating the faults which might be encountered. **[6 Marks]**

MINISTRY OF PORTS & HIGHWAYS

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING - SRI LANKA

EXAMINATOIN FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER UNLIMITED – OCTOBER 2013

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

SECTION A-Answer any SIX questions.

1. With reference to Ships Energy Efficiency Management Plan.
   a. Identify the ship specific energy efficiency methods known to you. **[4 Marks]**
   b. Explain how the ships scoop cooling arrangement can be help to improve the energy efficiency. **[4 Marks]**
   c. Write disadvantages of having scoop cooling system onboard. **[2 Marks]**

2. With reference to product tankers.
   a. Sketch and describe oil discharge monitoring system. **[6 Marks]**
   b. State the requirement to be fulfilled to operate the above system. **[2 Marks]**
   c. How and where do you log this operation. **[2 Marks]**

3.

   a. Sketch and describe a line diagram showing the layout and components of a constant pressure hydraulic system with one or more variable delivery pressure compensated pumps and an accumulator suitable for the operation of deck machinery. **[7 Marks]**

   b. State how you convert a vane type hydraulic pump in to a hydraulic motor. **[3 Marks]**

4. With reference an air operated fuel oil control valve for an auxiliary boiler combustion system.
   a. Sketch the valve labeling the component parts. **[4 Marks]**
   b. State the effect of air supply failure. **[2 Marks]**
   c. Describe how the valve can be operated manually. **[1 Mark]**
   d. State the factors which require a positioner to be fitted. **[3 Marks]**

5. You are the Second Engineer of a vessel subjected to an annual survey soon. For the fire appliances in a vessel of your choice plan a survey route listing the statutory items to be examined, the test required and information needed to facilitate the work for surveyor. **[10 Marks]**

6.
   a. Sketch and briefly describe fully automated air conditioning system. **[5 Marks]**
   b. Describe how conditioned air is maintained within the comfort range, outlining the effects on the crew, of air which is too dry. **[2 Marks]**
   c. Explain TWO methods of measuring relative humidity. **[3 Marks]**

7. With reference to steering gear systems briefly explain,
   a. Follow up steering gear. **[3 Marks]**
   b. Non-follow up steering gear. **[3 Marks]**
   c. Why the regulation state that the gear is to be tested from 35deg on one side to only 30deg on the other side in 28 seconds and the purpose of this test. **[4 Marks]**

8. Explain the action of the EACH of the followings metallurgical mechanisms.
   a. Creep. **[2 Marks]**
   b. Brinelling. **[2 Marks]**
   c. Fretting corrosion. **[2 Marks]**
   d. State with reasons where EACH of the above may occur in the ship propulsion system. **[4 Marks]**

SECTION B- Attempt only **TWO** question from this section (minimum of 8marks required)

9. With regards to high voltage electrical distribution system
   a. Explain advantages and disadvantages of having high voltage system. **[4 Marks]**
   b. As a Second Engineer state with reasons the items that should be included in a work permit for maintenance on a high voltage switch board. **[6 Marks]**

MERCHANT SHIPPING DIVISION
MINISTRY OF SHIPPING
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- ENGINEER OFFICER CLASS TWO- DECEMBER 2004

ENGINEERING KNOWLEDGE – MOTOR

Attempt six questions only

Marks for each part question are shown in brackets. Full marks will be given to answers with sketches

1. Describe how large slow speed, two cycle engines are structured to withstand the following:
   a. Forces due to combustion loads; (5)
   b. Guide forces; (5)
   c. Inertia forces; (6)

2. In engine rooms that are operated under UMS conditions describe with the aid of sketches how the following are monitored:
   a. The perforation of a high pressure fuel pipe (5)
   b. The imminence of possibility of a scavenge fire (5)
   c. Conditions that may be conducive to a crankcase explosion (6)

3. Describe the routine maintenance necessary on the following components in order to obtain optimum performance from a main engine turbocharger.
   a. Lubricating oil for ball bearings (4)
   b. Air intake silencer/ fitter (4)
   c. Turbine blades. (4)
   d. Diffuser ring (4)

4.
   a. Explain the reasons for employing two air inlet and two exhaust valves for high powered trunk piston 4-stroke engines. (4)
   b. State the problems relating to tappet setting with such valves (4)
   c. Sketch a caged valve as fitted to a trunk piston engine (8)

5. With reference to camshafts:
   a. Discuss the type of bearing commonly employed to carry camshafts on large engines, (5)
   b. Explain why 'wear down' in camshaft bearings is critical to engine operation, (5)
   c. Explain why the angular position of the camshaft may need adjustment after an extended period in service. (6)

DOC110118-003
(A3 → A4) - 175/-

DOC 260 718 -001 (A4 - A4) NEW 325/-

6. Describe how the following conditions are caused and dealt with:
   a. Gradual decrease in scavenge pressure, (4)
   b. Sudden increase in scavenge pressure, (4)
   c. Scavenge air temperature consistently above normal (4)

   Outline the limitations of the use of these methods of monitoring engine performance. (4)

7. Describe the effects of the following faults in multi-stage reciprocating air compressors:
   a. Inter stage cooler starved of cooling water, (4)
   b. Worn crankshaft bearings, (4)
   c. Broken or worn scraper rings, (4)

   Suggest a 'fail safe' arrangement in the event of inter stage cooler water loss (4)

8. Sketch in detail a section through a hydraulic governor as fitted to medium speed unidirectional engines. (8)

   Explain how it operates under frequent and wide load changes. (8)

9.
   a. Outline the essential steps in the structural examination of an auxiliary boiler (6)
   b. Discuss briefly where wastage is likely to be found (6)
   c. Explain why it is equally important to examine the fire side as the water side. 4)

10. With reference to the protection of electric motors explain EACH of the followings.
    a. Fuse back up protection. **[3 Marks]**
    b. How a motor fitted with fuse back up protection may exceed its rated temperature without being tripped by its primary protection system. **[4 Marks]**
    c. A means of protection for a motor to safeguard the rated temperature being exceed. **[3 Marks]**

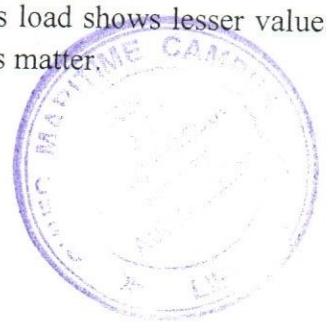
11. With respect to PVC insulated cables, briefly describe the effects of the following on the insulation.
    a. At temperature below 0 degree Centigrade. **[4 Marks]**
    b. At temperature above 20 degree Centrigrade. **[6 Marks]**

SECTION C- Attempt only **TWO** question from this section (minimum of 8marks required)

12. With reference to large container carriers.
    a. Sketch a transverse section of a modern container carrier. **[4 Marks]**
    b. Explain how the design and operation of this type of vessel has contributed to structural failure. **[3 Marks]**
    c. Describe the designs that have evolved to minimize the possibility of failure. **[3 Marks]**

13. Explain EACH of the following with regards to thickness measurements and acceptance criteria.
    a. Gauged thickness. **[2 Marks]**
    b. Reserve thickness. **[2 Marks]**
    c. Renewal thickness. **[2 Marks]**
    d. Voluntary thickness addition. **[2 Marks]**
    e. Substantial corrosion. **[2 Marks]**

14. With regards to intermediate shaft bearings.
    a. Explain how the bearing load test is carried out. **[6 Marks]**
    b. After the load test, all the bearings load shows lesser values than the desired values. Outline the probable causes for this matter. **[4 Marks]**



14. Define each of the following, stating the purpose of each: (2 marks each)

a. Sheer;
b. Camber;
c. Bilge keel;
d. Freeboard;
e. flare

3. a) Describe, with the aid of a sketch, an engine room High Fog smothering system. (8)

b) explain advantages and disadvantages of the above system over systems which employ an inert gas. (2)

7. Diesel Electric propulsion is now being chosen as the power plant for an increasingly wide variety of vessels.
   (a) Sketch a simple layout of such an installation. (6)
   (b) Explain the advantages of selecting such a plant. (4)

8. With reference to a pneumatic valve positioner incorporating a volume booster:
   a) Explain, with the aid of a sketch, the operation of a positioned; (7)
   b) Outline the immediate action to be taken to restore automatic control upon failure of the positioned bellows. (3)

SECTION B

Answer any two questions from this section- Minimum of 8 marks is required from this section

9. a Describe, with the aid of an sketch, a high rupturing capacity fuse (4)
   b. Explain the term "discrimination" when applied to electrical protective devices (4)
   c. State how over current devices are tested. (2)

10. With reference to alternating current generators, explain each of the following: (2 marks each)
    a. Salient pole.
    b. Rotary excitation.
    c. Static excitation.
    d. Diode.
    e. Rectifier.

11. With reference to an automatic voltage regulator (AVR) for an alternator, describe, with the aid of a circuit diagram, how the reference signal is produced and processed to give a deviation signal required by the A.V.R. control (10)

SECTION C

Answer any two questions from this section- Minimum of 8 marks is required from this section

12. Describe the examination of a rudder in dry dock. (10)

13. With reference to the drainage of water from a ship's external structure, explain each of the followings:
    a. Why scuppers are located in close proximity to superstructure whereas freeing ports are generally located at open areas of the weather deck; (3)
    b. Why it is essential that scuppers and freeing ports should function satisfactorily at all times; (4)
    c. Why oil tankers have ship's side guard rails abreast cargo tanks for reasons other than safety of personnel.

2/E

2011

MERCHANT SHIPPING DIVISION
MINISTRY OF PORTS AND HIGHWAYS
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER OFFICER - UNLIMITED- OCTOBER 2011

ENGINEERING KNOWLEDGE – GENERAL
Time allowed three hours

Answer any six questions from Part A, two questions from Part B and two questions from Part C.
Answers with clear sketches/diagrams, neat hand writing and clear expression will get full marks

Part A Answer any six questions

1. (a) Sketch a single cylinder, double acting reciprocating pump, labeling the component parts and explain how pressure fluctuations are dampened. (7).
   (b) State, with reasons, the duties that the pump sketched in Q1(a) is particularly suited.(3)

2. (a) Sketch a steering gear arrangement capable of 100 percent redundancy. (5)
   (b)Describe the operation of the arrangement in Q.2(a) when the working pump oil manifold develops a serious leak and describe. (5)

4. a) Explain, with the aid of a diagram, the pressure distribution of the lubricant in a journal bearing. (4)
   b) Explain, how each of the following parameters affect lubrication in a journal bearing: (2 marks each)
   - i) Speed rotation.
   - ii) Viscosity
   - iii) Surface finish

5. With reference to corrosion processes:
   (a) Explain the mechanism of Stress corrosion; (2)
   (b) State where the following types of corrosion may occur with specific examples , and the materials commonly involved in each case. (2 marks each)
   (i) Fretting corrosion; (ii) Impingement corrosion;
   (iii) Galvanic corrosion; (iv) Crevice corrosion.

6. An auxiliary boiler water level control system has a differential pressure transmitter as the detecting element for water level.
   (a) Sketch and describe such an arrangement. (6)

   (b) If the transmitter was damaged describe how a replacement unit would be calibrated.(4)

10. (a) Explain the operation of a silicon controlled rectifier; (6)

(b) Explain with reasons, four typical shipboard applications where silicon controlled rectifiers are employed. (4)

11. With reference to the paralleling of alternators:

(a) outline the principles of synchronisation; (2)
(b) explain how the KW power is shared; (1)
(c) explain how K var is shared. (1)
(d) explain six types of damage may be caused when machines are incorrectly synchronized. (6)

SECTION C- Attempt only two question from this section (minimum of 8 marks required)

12. With reference to the structure of a large passenger vessel:

(a) Describe how the spread of fire and smoke is prevented; (7)
(b) Describe the standard fire test for a Class A 60 Divisional material. (3)

13. The palm of the rudder of a vessel requires extensive welding repairs and as Second Engineer you are requested to supervise.

(a) Suggest a suitable type of welding process. (4)
(b) State, with reasons, common welding defects that can occur there. (3)
(c) State what tests may be carried out before returning the rudder to service. (1)

14. Explain the function of a collision bulkhead and, with the aid of sketches, describe features of its construction and attachment to decks, shell plating and double bottom. (10)

MERCHANT SHIPPING DIVISION
MINISTRY OF PORTS AND HIGHWAYS
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER OFFICER- UNLIMITED- FEBRUARY 2012

ENGINEERING KNOWLEDGE – GENERAL
Time allowed three hours
Answer any six questions from Section A, two questions from Section B and two questions from Section C
Answers with clear sketches/diagrams, neat hand writing and clear expression will get full marks

SECTION A- Answer any six questions

1. Explain the principle of port State control and give in detail the verification the port State control Officer may carry out with particular reference to the following; (10)
   (a) Emergency generator
   (b) Auxiliary steering gear
   (c) Lifeboat engine
   (d) Bilge pumps
   (e) SOPEP

2. With reference to ISM write short notes on:
   (a) Advantages of drills and procedures. (3)
   (b) Management review (2)
   (c) Master's overriding authority. (2)
   (d) Critical equipment and their maintenance (3)

3. With reference to oil monitoring of bilge and tanker ballast discharges
   (a) Describe with the aid of a sketch, the general arrangements of an oil monitoring system; (4)
   (b) State the inputs that are recorded; (3)
   (c) Explain the difficulties encountered with the efficient operation of the oil monitoring. (3)

4. Describe in detail each of the following processes and give an example where each is likely to occur in marine engineering:
   State how in each case the initiation of the process is prevented or minimized.
   a) Corrosion fatigue (3)
   b) Stress corrosion (2)
   c) Creeping cracks (3)
   d) Casting cracks (2)

5. With reference to a hydraulic steering gear explain each of the following:

(a) i the factors which may contribute to the failure of pipe coupling; (3)

ii. Why it is of the utmost importance that in the event of a pipe coupling failing, immediate cantering or locking of the rudder or isolation of the affected area in achieved; (3)

iii. The problems associated with locking a rudder for emergency repairs at sea during heavy weather; (2)

(b) Explain the required characteristics for steering gear hydraulic fluid. (2)

6. With reference to main refrigeration plant give a reason for each of the following operational irregularities and state how it is dealt with:

a) Rapid loss of crankcase lubricating oil in a "vee" block machine (3)

b) Gradual "fall off" in the refrigeration effect over a comparative short period of time (3)

c) Icing up at compressor suction (2)

d) Frequent cutting off of compressor on high pressure. (2)

7. Separation rate is inconsequential in oily water separators

Discuss with reasons the one statement that is not correct regarding oily water separators. (10)

a) Test cocks are situated to locate the oil-water interface
b) Separation rate is inconsequential
c) Overboard discharge is inconsequential
d) Rise in temperature assist in the separation process
e) Rate of separation is unrestricted

8. Describe the term volumetric efficiency as related to air compressor (4)

Describe the effect of the following faults in multi stage reciprocating air compressor. (2 marks each)

a) Inter stage cooler starved of cooling water.
b) Worn crank shaft bearing
c) Broken or worn scarper ring

Suggest a failsafe arrangement in the event of inter stage cooler water loss.

SECTION B- Attempt only two question from this section (minimum of 8 marks required)

9. With reference to a three phase shipboard electrical distribution system:

(a) explain advantages of an insulated neutral system; (4)

(b) explain disadvantages of an insulated neutral system; (4)

(c) describe how an earth neutral system is earthed. (2)

2012 –2009

MERCHANT SHIPPING DIVISION
MINISTRY OF PORTS AND HIGHWAYS
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER OFFICER- UNLIMITED- FEBRUARY 2012

ENGINEERING KNOWLEDGE –MOTOR
Time allowed three hours
Answer any six questions
Answers with clear sketches/diagrams, neat hand writing and clear expression will earn full marks

1. Exhaust emission control is a major global issue and under serious consideration by world shipping, comment on the following:
   a. Primary NOx reduction measures. (5)
   b. Secondary reduction measures. (5)
   c. Explain with reasons, which system will be more effective. (6)

2. With respect to cylinder lubrication,
   a. State how you would adjust the feed rate of cylinder lubricating oil, the load-dependent cylinder lubrication, Feed rate of lubricating oil at the running-in phase. (8)
   b. What is Pre and post-lubrication (4)
   c. What is Emergency lubrication (4)

3. a. State the purpose of nip and tangs for thin shell bearings. (5)
   b. How the bearing shell may become loose during service. (5)
   c. Explain the procedure and checks that should be undertaken during reassembly of the medium speed main engine bottom end bearing to ensure safe operation, (6)

4. What is the difference from design aspect of the crosshead lubrication arrangements in the two engines that make it necessary to have a separate high pressure pump in one make of engine, while the other one does not need such pump. (16)

5. Severe damage at the crosshead pin and bearing of one unit. The crosshead pin cannot be replaced at this time. State the actions to be taken in order to ensure that the main engine can be operated, the precautions which shoud be taken whilst running the engine after the remedial action. (16)

6. Modern day slow speed engines operate on the Common Fuel Rail concept.

a) Name all the important equipment and components on a common rail engine fuel oil system (6)

b) Describe the operation of a ICU (injection control unit). [Assume that the engine control system has given out the command for injection to take place. Explain in point form how the injection is taking place.] (6)

c) During manoeuvring or in congested waters, if a quantity sensor of an ICU is failing, as a Second Engineer what action you could take to avoid interruption of the Main Engine operation. (4)

7. (a) Describe, with the aid of an sketch, an air starting system for a large slow-speed engine, labelling all components. (10)

(b) Explain how a leaking air start valve could be detected in each of the following:

i. with the engine out of service. (2)

ii. While manoeuvring the engine (2)

(c) State an appropriate course of actions in the event of Q 7 (b) (ii) (2)

8. With reference to a newly acquired vessel which has been laid up:

(a) describe the preliminary checks that should be carried out before starting a medium speed main propulsion engine. (8)

(b) describe the checks that should be made after starting the engine. (8)

9. With reference to diesel engine maintenance:

(a) describe the various means that are available to check the condition of a diesel engine as a guide to identify when maintenance is actually needed; (8)

(b) compare the methods described in Q.9(a) with the use of planned maintenance scheme. (8)

12.
a. Explain the term soft starting when applied to the electric motors. [2 Marks]
b. Describe with the aid of diagram a solid state soft starting system. [5 Marks]
c. State the advantages of solid state soft starting arrangements. [3 Marks]

11. With reference to the potential hazards of the misuse of electrical test equipments.
a. State the necessary precautions when testing live voltages using a multimeters. [3 Marks]
b. What are the potential dangers of using non-ship issued multimeters. [4 Marks]
c. State the precautions to be observed when carrying out insulation test of intrinsically safe equipment type Exi. [3 Marks]

SECTION C- Attempt only **TWO** question from this section (minimum of 8marks required)

12. With reference to tanks for the carriage of liquefied gas at very low temperatures.
a. Describe with the aid of a sketch ONE method of building up insulation. [4 Marks]
b. State with reasons the alloy which used for the membrane. [2 Marks]
c. Describe with the aid of a sketch how free standing tanks for the carriage of gas are located and supported. [4 Marks]

13.
a. With the aid of a sketch, show the method of attachment which allows a semi balance rudder to pivot. [3 Marks]
b. Explain how the angular and vertical movements of a semi balanced rudders are limited, giving typical limits. [2 Marks]
c. Outline the procedure for the inspection of a rudder in dry dock. [5 Marks]

14.
a. Explain the purpose of transverse watertight bulkheads. [4 Marks]
b. Describe using sketches as necessary how EACH of the followings are passed through a watertight bulkhead.
i. Electrical cable. [2 Marks]
ii. Main transmission shaft. [2 Marks]
iii. Ballast line. [2 Marks]

2014

MINISTRY OF HIGHWAYS PORTS & SHIPPING

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING - SRI LANKA

EXAMINATOIN FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER UNLIMITED – JANUARY 2014

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

SECTION A-Answer any SIX questions.

1. a. State TWO publications where information can be obtained with regards to the safe carriage of hazardous substances as cargo. **[2 Marks]**
   b. With reference to a vessel carrying a hazardous substance as cargo discuss each of the following.
      i. Storage and transport. **[2 Marks]**
      ii. Hazardous properties. **[2 Marks]**
      iii. Firefighting and suppression techniques. **[2 Marks]**
      iv. Medical effects and treatment after physical contact with the cargo. **[2 Marks]**

2. a. Explain why the properties of mild steel make it suitable for many marine engineering purposes. **[3 Marks]**
   b. State the effects of increasing the carbon content of plain carbon steel. **[3 Marks]**
   c. Give TWO instances where the physical properties of steel are modified by alloying, giving reasons for this modification. **[4 Marks]**

3. a. Describe with the aid of a sketch, how automatic bunker fuel oil transfers take place, detailing all the safety devices incorporated in the system. **[6 Marks]**
   b. Explain how the safeguards described above are tested. **[4 Marks]**

4.

a. Summaries MARPOL Annex IV sewage regulation with regards to the discharge of sewage. [4 Marks]

b. Sketch and describe zero discharge sewage system labelling the component parts and indicating the direction of flow. [6 Marks]

5. In view of the number of fatalities involving inert gas used for fire fighting purposes in the machinery spaces ,your company is considering alternative methods of protection. As Second Engineer compile a letter to the company expressing your views for the retention or rejection of inert gas systems and stating your opinions on viable alternative systems. [10 Marks]

6. With reference to reciprocating compressors for refrigeration duties.

a. Sketch the relief and unloading arrangements. [4 Marks]

b. Explain why relief and unloading arrangements are provided. [2 Marks]

c. A refrigeration compressor controlled on start/stop is observed to be running excessively. State reasons for the excessive running of the compressor. [4 Marks]

7. With reference to rudder carrier bearings,

a. Sketch and describe such a bearing. [6 Marks]

b. State how the bearing is aligned with the ship. [2 Marks]

c. State how adjustment is made to compensate for weardown. [2 Marks]

8. With regards to care of lubricating oils onboard answer the followings.

a. Microbial degradation of lubricating oil and measures to prevent the same. [4 Marks]

b. Methods of ensuring correct sampling is done for the purpose of shore based testing. [2 Marks]

c. If the shore based testing result shows some abnormal values of water content and TBN for the crank case lub.oil of a slow speed main engine what will be interpretation and subsequent action. [4 Marks]

SECTION B- Attempt only **TWO** question from this section (minimum of 8marks required)

9. Explain what is mean by and the significance of the following terms with regards to high voltage electrical distribution system.

a. Dead front switch board. [4 Marks]

b. Harmonic filters. [3 Marks]

c. Vacuum breakers. [3 Marks]

MERCHANT SHIPPING DIVISION
MINISTRY OF PORTS AND HIGHWAYS
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER OFFICER- UNLIMITED- OCTOBER 2011

ENGINEERING KNOWLEDGE –MOTOR
Time allowed three hours
Answer any six questions
Answers with clear sketches/diagrams, neat hand writing and clear expression will get full marks

1. Write a risk assessment for the removal and inspection of a crosshead engine piston. (16)

2. a. Sketch a generator engine fuel system, showing the facilities for heavy fuel oil heating and changing over from heavy grade fuel to low sulphur oil operation. (6)

   b. For the system sketch above, explain the procedure for changing a single generator engine from heavy fuel operation to low sulphur operation. (6)

   c. Explain the purpose of a blackout pump, stating how it operates. (4)

3. a. Sketch a generator starting air system employing an air motor. (6)

   b. Describe how the starting air system sketched above operates. (6)

   c. Describe the actuation and operation of a backup starting system for an emergency generator employing either a spring starter or a hydraulic starter. (4)

4. With reference to waste heat steam generating systems:

   a) Explain why a steam dump facility is required; (4)
   b) sketch a steam dump system showing how the steam pressure is controlled; (6)
   c) describe how the steam dump system above is put into service, explaining how it operates. (6)

5. With reference to a main engine starting air system:

   a) explain why slow turning system is fitted. (4)
   b) explain how the slow turning system operates when an engine start it initiated; (4)
   c) write a procedure for determining the reason for a main engine starting air system failing to operate. (6)

6. With reference to the local control of a main engine following failure of the automatic control system, explain how the engine can be monitored and controlled. (16)

7. (a) Sketch a diesel engine high pressure common rail fuel system, labeling the main parts. (8)

(b) Describe how the common rail system sketched above operates, explaining how fuel injection timing is controlled. (8)

8. With respect to trunk piston engines state, with reasons, the causes, effects and means of avoidance of:

(a) Carbonization of crankcase oil; (5)

(b) Excessive piston ring wear; (6)

(c) High levels of water in crankcase oil. (5)

9. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating reasons for each action. The procedure must cover the period from activation of the alarm to return of the engine to normal. (16)

MERCHANT SHIPPING DIVISION
MINISTRY OF PORTS AND HIGHWAYS
SRI LANKA

EXAMINATION FOR CERTIFICATE OF COMPETENCY- SECOND ENGINEER OFFICER- UNLIMITED- JULY 2011

ENGINEERING KNOWLEDGE –GENERAL

Time allowed three hours

Answer any six questions from Section A, two questions from Section B and two questions from Section C

Answers with clear sketches/diagrams, neat hand writing and clear expression will get full marks

SECTION A- Answer any six questions

1. Discuss the effects of varying the percentages of the following constituents on the physical properties of steel: (2 marks each)
   (a) Carbon,
   (b) phosphorus,
   (c) manganese,
   (d) molybdenum
   Define for each of any, three alloy steels of different specification, its metallurgical composition, mechanical properties and the reason for selection in a specified marine machinery application. (2)

2. With reference to centrifugal pumps:
   (a) Sketch typical discharge characteristics showing variation of throughput as discharge head is varied; (2)
   (b) Explain, with reference to pump characteristic curves, the effect of the following on PUMP performance: (2 marks each)
   (i) pump started with delivery valve shut;
   (ii) pump started with suction valve shut;
   (iii) cooler division plate carried away;
   (iv) reduction in cross sectional area of the discharge pipe to fifty per cent of the nominal area.

3. (a) Distinguish between 'fixed temperature' and 'rate of temperature rise' types of fire detectors and state with reasons where they are likely to be located. (4)
   (b) Sketch and describe a fire detector of the 'rate of temperature rise' type. (2)
   (c) Explain how compensation is made for a slow rise in ambient temperature. (2)
   (d) Describe how to verify that the fire detectors in machinery space are in working order. (2)

4. With regards to main transmission shaft flange coupling arrangements:
   (a) Sketch a hollow type coupling bolt and the hydraulic head/nut and loading rod which are used to fit it; (6)
   (b) Describe how the bolt is fitted, (2)
   (c) State the advantage of the hollow coupling bolt as compared to the traditional type of coupling bolt. (2)