Y2

Applied Marine Engineering

Example examination questions

Note: any example exam paper after September 2005 is based upon the new engineering syllabus, (ref MIN208).

APPLIED MARINE ENGINEERING **November 2005**

Attempt ALL questions

Marks for each question are shown in brackets

1. (a) Explain how stray electrical currents may contribute to electrolytic corrosion. (4)

   (b) Describe a full procedure for determining whether stray currents exist on a d.c. battery supplied system, highlighting the safety considerations. (6)

2. List FIVE materials that may be used for the manufacture of propellers, explaining the desirable properties of EACH material. (10)

3. (a) Describe the crackle test for water in oil. (2)

   (b) State the lowest concentration (ppm) of water the crackle test is likely to detect. (1)

   (c) Describe the limitations of the crackle test. (2)

   (d) State FIVE methods in which water may be removed from oil. (5)

4. (a) Describe FOUR factors influencing centrifugal separator efficiency. (4)

   (b) Explain how oil loss occurs in a separator, stating how this can be minimised. (4)

   (c) State the factors determining the discharge frequency of an engine lubricating oil purifier. (2)

5. Describe ALL the checks that should be performed on an electric starter motor that appears faulty before removing the starter motor from the engine. (10)

6. (a) Describe the sequence for testing sealing tightness of cylinder air start valves before operating the engine. (8)

   (b) List the safety precautions required before working on engine air start valves. (2)

7. Explain EACH of the following electrical terms:

   (a) reverse power tripping; (2)

   (b) instantaneous over current trip; (2)

   (c) inverse time over current trip; (2)

   (d) circuit discrimination; (2)

   (e) short circuit. (2)

8. (a) Sketch the relationship between *true power (kW)*, *apparent power (kVA)*, *reactive power (kVAr)*, and *power factor (cosΦ)*. (4)

   (b) Explain the consequence if the *reactive power (kVAr)* is not shared equally between two generators operating in parallel. (4)

   (c) Explain how kW and kVAr load sharing stability is achieved. (2)

9. Describe, with the aid of a block diagram, how analogue plant process signals can be supplied to a central computer control system, and output signals from the processor can be used for analogue control equipment. (10)

10. (a) Outline FIVE advantages of pneumatic control valves. (5)

    (b) Outline FIVE disadvantages of pneumatic control valves. (5)

Attempt ALL questions

Marks for each question are shown in brackets

1. A vessel has been laid up for a considerable time with shore power connected. Routine underwater hull inspections reveal an unusually high deterioration rate of the vessel's anodes. Assuming the dockside wiring, shore power connections and bonding systems are all in good condition and correctly connected:

   (a) explain how this may occur; (8)

   (b) state TWO devices that should be fitted to prevent this situation occurring. (2)

2. List FIVE common alloying elements used in steel, explaining how EACH of these modifies the properties of the steel. (10)

3. (a) State FOUR functions of lubricating oil. (4)

   (b) Explain EACH of the following terms:

   (i) hydrostatic lubrication; (2)

   (ii) boundary lubrication. (2)

   (c) State ONE advantage and ONE disadvantage of using grease as a lubricant in a plain bearing. (2)

4. Explain EACH of the following terms:

   (a) absorbent filter; (2)

   (b) adsorbent filter; (2)

   (c) magnetic filter; (2)

   (d) magnetic plug; (2)

   (e) five micron filter. (2)

5. Sketch a Direct-on-Line a.c. starter including the auxiliary circuit, labelling the MAIN components. (10)

6. (a) List FOUR safety interlocks that may be fitted to a direct air start medium speed diesel engine to prevent inadvertent starting during maintenance. (4)

   (b) Explain, with the aid of a diagram, the opening period of an air start valve on a four stroke diesel engine in relation to the crank angle, inlet and exhaust valves. (6)

7. List FIVE safety devices that may be fitted to an a.c. induction motor and its associated control gear to protect the motor against burnout, stating the reason why EACH is used. (10)

8. Describe the FULL procedure for paralleling an incoming a.c. generator to another a.c. generator connected to the main switchboard. (10)

9. (a) Describe, with the aid of a diagram, the mode of operation of a *two step controller.* (6)

   (b) Explain how the addition of proportional and integral control will improve the action of the controller described in Q9(a). (4)

10. (a) Sketch a labelled block diagram of a closed loop process control system, showing the set value, deviation, and measured value points. (4)

    (b) Describe the function of EACH control block sketched in Q10(a). (6)

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APPLIED MARINE ENGINEERING April 2005

Attempt ALL questions

Marks for each question are shown in brackets

1. (a) Explain how steel is modified by its carbon content. (4)

   (b) Explain EACH of the following terms:

   (i) annealing; (2)

   (ii) normalising; (2)

   (iii) hardening. (2)

2. State, with reasons, a <u>different</u> material suitable for EACH of the following applications:

   (a) a large motor yacht propeller; (2)

   (b) a centrifugal pump impeller; (2)

   (c) a sea water cooled heat exchanger tube; (2)

   (d) a 300mm diameter sea water cooling pipe; (2)

   (e) the hull of a 40 metre sailing yacht. (2)

3. (a) Explain how the lubricating oil of a diesel engine may become contaminated with water. (6)

   (b) List the problems that water in an engine oil may cause. (4)

4. (a) Explain the difference between the terms *Higher Calorific Value* and *Lower Calorific Value.* (2)

   (b) State, with reasons, which value is normally quoted. (1)

   (c) List the other quality requirements used in the specification of a marine fuel. (7)

5. With reference to a Bendix (inertia type) starter motor:

   (a) explain what is meant by the term *out-of-mesh clearance*; (2)

   (b) explain why this clearance is important; (2)

   (c) describe how this clearance can be checked; (5)

   (d) state a suitable value for the *out-of-mesh clearance*. (1)

6. List TEN safety devices that may be fitted to a propulsion engine and gearbox arrangement. (10)

7. The remote start button has been pressed to start an a.c. induction motor, but without indication that the motor has started. Outline the checks that should be performed to locate any possible problem. (10)

8. (a) Sketch a line diagram showing an arrangement for an emergency generator and emergency switchboard, labelling the MAIN components. (8)

   (b) With reference to the diagram in Q8(a), explain how the connection of the emergency generator to the emergency switchboard is prevented whilst main power is still being supplied. (2)

9. (a) Explain the limitations of a proportional controller. (2)

   (b) Explain, with the aid of diagrams, how the limitations explained in Q9(a) may be overcome. (8)

10. Sketch a proportional plus integral pneumatic controller (two term controller), labelling ALL components. (10)

March 2005

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. State the MAIN constituent elements of EACH of the following materials:

   (a) aluminium brass; (2)

   (b) aluminium bronze; (2)

   (c) cupro-nickel; (2)

   (d) monel metal; (2)

   (e) austenitic stainless steel. (2)

2. (a) Explain the desirable properties required from materials selected for the manufacture of propellers. (5)

   (b) List the materials that may be used for the manufacture of propellers. (5)

3. (a) Describe the crackle test for water in oil. (2)

   (b) State the lowest concentration (ppm) of water the crackle test is likely to detect. (1)

   (c) Describe the limitation of the crackle test. (2)

   (d) State FIVE methods in which water may be removed from oil. (5)

4. (a) Explain how water contamination may affect the properties of a lubricating oil. (4)

   (b) List SIX possible causes of thermal degradation of a lubricating oil. (6)

5. Detail ALL the checks that could be performed on an electric starter motor that appears faulty before removing the starter from the engine. (10)

6. (a) Describe the sequence for testing sealing tightness of cylinder air start valves before operating the engine. (8)

   (b) List the safety precautions required before working on engine air start valves. (2)

7. Explain EACH of the following electrical terms:

   (a) reverse power tripping; (2)

   (b) sequential starting; (2)

   (c) instantaneous overcurrent; (2)

   (d) discrimination; (2)

   (e) short circuit. (2)

8. (a) Sketch the relationship between *true power (kW), apparent power (kVA), reactive power (kVAr),* and *power factor (cosφ).* (4)

   (b) Explain how true power (kW) and reactive power (kVAr) is shared between two generators connected in parallel. (4)

   (c) Explain how kW and kVAr load sharing stability is achieved. (2)

9. Describe, with a block diagram, how analogue plant process signals can be supplied to a central computer control system, and output signals from the processor can be used for analogue control equipment. (10)

10. Sketch a basic pneumatic transmitter of the flapper/nozzle type incorporating feedback, labelling ALL components. (10)

APPLIED MARINE ENGINEERING **January 2005**

Attempt ALL questions

Marks for each question are shown in brackets

1. List FIVE methods for non-destructive crack detection, stating one disadvantage for EACH method. (10)

2. (a) Explain the process of *brazing* for the joining of metals and alloys. (4)

   (b) State TWO methods by which a cracked aluminium alloy pump casting might be repaired. (2)

   (c) List the FOUR functions that the flux performs in the *brazing* process. (4)

3. With reference to engine lubricating oil filtration:

   (a) explain the term *cleanliness* of the oil; (2)

   (b) state, with reasons, the checks that should be performed on the filter components. (8)

4. (a) Explain what is meant by the storage flash point of a fuel, outlining the importance of the flash point value for the storage of fuel. (4)

   (b) Explain how the flash point of a lubricating oil may change in service. (2)

   (c) Explain why a lubricating oil is heated before treatment in a centrifugal separator. (4)

5. (a) Outline the SOLAS requirements for the starting system for emergency generators on board ship. (5)

   (b) State the approved types of starting system suitable for an emergency diesel driven generator. (5)

6. (a) Explain why a starter motor solenoid is used in an electric starting circuit. (2)

   (b) Explain why a starter motor solenoid may have two windings. (4)

   (c) Sketch an electric starting circuit with a two winding solenoid. (4)

7. With reference to battery installation on board:

   (a) explain the term *vented type battery*; (2)

   (b) explain the term *sealed type battery*; (2)

   (c) for large battery banks (charging power greater than 2kW) detail the regulations governing installation, ventilation and location for EACH of the following:

   (i) vented type batteries; (4)

   (ii) sealed type batteries. (2)

8. With reference to paralleling and load sharing of generators, explain EACH of the following:

   (a) the possible causes of no voltage indication on start up of a stand-by generator; (2)

   (b) the purpose of the check synchroniser; (2)

   (c) the reason for the incoming machine to be running slightly faster than the busbar frequency at the instant of closing the incoming breaker; (2)

   (d) how equal kW load sharing is maintained; (2)

   (e) why the power factors may be different even though the kW loads are equal. (2)

9. Explain EACH of the following control terms:

   (a) setting time; (2)

   (b) stability; (2)

   (c) dead zone; (2)

   (d) hysteresis; (2)

   (e) bandwidth. (2)

10. Describe a method of measuring and remotely indicating EACH of the following :

   (a) temperature; **(5)**

   (b) flow. **(5)**

APPLIED MARINE ENGINEERING **November 2004**

Attempt ALL questions

Marks for each question are shown in brackets

1. (a) Sketch the surface appearance of a fatigue fracture. (4)

   (b) Describe the different areas visible in the fracture sketched in Q1(a), explaining the reasons for the different markings. (6)

2. List FIVE common alloying elements used in steel, explaining how EACH of these modifies the properties of the steel. (10)

3. (a) List the problems that fluid aeration may cause in hydraulic oil systems. (5)

   (b) List the possible sources of bubble formation (aeration) within an oil circulation system. (5)

4. (a) Explain the importance of the Cetane Number for a distillate fuel used in a compression ignition engine. (4)

   (b) Sketch a line diagram to show the fuel supply system for a typical large medium speed diesel main engine from bunker tank to engine, labelling all components. (6)

5. (a) Explain, with the aid of a diagram, the operation of a solenoid operated, battery powered electric starting system for an internal combustion engine. (6)

   (b) Explain the term *pre-engaged starter*. (4)

6. (a) Describe the safety interlocks that may be fitted to a typical large medium speed diesel engine to prevent inadvertent starting during maintenance. (4)

   (b) Explain, with the aid of a diagram, the opening period of an air start valve on a four stroke diesel engine. (6)

7. Describe FIVE safety devices that may be fitted to an a.c. induction motor and its associated control gear to protect the motor against burnout. (10)

8. Describe the full procedure for paralleling an incoming a.c. generator to another a.c. generator connected to the main switchboard. (10)

9. Sketch a basic pneumatic transmitter of the flapper/nozzle type incorporating feedback, labelling all components. (10)

10. (a) Sketch a labelled block diagram of a closed loop process control system, showing the set value, deviation, and measured value points. (4)

(b) Describe the function of EACH control block sketched in Q10(a). (6)

02-04

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. A drydock inspection of the stainless steel alloy propeller shafts has revealed serious pitting corrosion of the shafts in the region where the shafts pass through the stern tube. The stern tube arrangement consists of a shaft seal and a sea-water flooded stern tube with cutlass bearing at the aft (sea) end.

   (a) Describe the possible reasons for this corrosion. (6)

   (b) Describe the modifications that could be made to the stern tube arrangement to reduce the likelihood of future shaft corrosion. (4)

2. (a) Outline THREE disadvantages of using aluminium in vessel construction. (3)

   (b) Outline THREE advantages of using steel in vessel construction. (3)

   (c) Outline FOUR conditions necessary in the preparation of steel surfaces prior to painting, to ensure a good surface finish. (4)

3. (a) Explain the difference between *closed* flash point and *open* flash point. (5)

   (b) Outline FIVE other tests that could be performed on an oil sample. (5)

4. Describe FIVE ways in which a marine fuel oil may be treated on board a vessel prior to use in the engine. (10)

5. With reference to the operation of an air starting system of a large medium speed marine diesel engine fitted with individual air starting valves:

   (a) state the checks to be carried out if the engine will not start when initiating the start sequence; (6)

   (b) list FOUR safety devices fitted to the air start system. (4)

02-04

6. Sketch an air piston (pilot air) operated starting air valve for a large medium speed marine diesel engine, labelling the main components. (10)

7. Describe the procedure, after starting the prime mover, for paralleling an incoming a.c. generator to another a.c. generator connected to the main switchboard. (10)

8. With reference to a 3-phase motor supplied with a six terminal connection without links, describe, with the aid of sketches, how the phase ends can be identified and the motor connected to run in permanent delta mode. (10)

9. (a) Explain why *double seat valves* are used in control valves. (4)

   (b) Outline why a valve positioner may be used. (2)

   (c) State FOUR circumstances where a valve positioner may be used. (4)

10. (a) Sketch a diaphragm type pressure alarm, with manual adjustment. (5)

    (b) Describe the operation of the alarm sketched in Q10(a). (5)

09-03

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. Explain how EACH of the following is carried out for mild steel:

   (a) hardening; **(2)**

   (b) tempering; **(2)**

   (c) nitriding; **(2)**

   (d) normalising; **(2)**

   (e) gas carburising. **(2)**

2. Explain EACH of the following terms:

   (a) galvanic corrosion; **(2)**

   (b) cavitation damage; **(2)**

   (c) erosion damage; **(2)**

   (d) stress corrosion; **(2)**

   (e) atmospheric corrosion. **(2)**

3. *(a)* State FOUR functions of lubricating oil. **(4)**

   (b) Explain EACH of the following terms:

   (i) hydrostatic lubrication; **(2)**

   (ii) boundary lubrication. **(2)**

   (c) State ONE advantage and ONE disadvantage of using grease as a lubricant in a plain bearing. **(2)**

4. With reference to lubricating oil and hydraulic systems:

   (a) list FOUR undesirable results likely to occur if the viscosity of the oil is *too high*; **(4)**

   (b) list FOUR undesirable results likely to occur if the viscosity of the oil is *too low*; **(4)**

   (c) describe TWO factors that might alter the viscosity of a lubricating oil in service. **(2)**

09-03

5. With reference to the operation of an air starting system of a medium speed marine diesel engine fitted with individual air starting valves:

   (a) state the checks to be carried out if the engine will not rotate when initiating the start sequence; **(6)**

   (b) list FOUR safety devices fitted to the air start system. **(4)**

6. *(a)* Describe how the starting arrangement for a diesel engine can be isolated to allow safe commencement of maintenance work. **(6)**

   (b) State the safety considerations that need to be heeded before immobilising the main propulsion plant. **(4)**

7. *(a)* List FIVE safety devices that may be fitted to an a.c. induction motor and its associated control gear to protect the motor against burnout. **(5)**

   (b) Explain what is meant by *single phasing* of 3-phase motor. **(5)**

8. Explain EACH of the following electrical terms:

   (a) preferential tripping; **(2)**

   (b) sequential starting; **(2)**

   (c) fuse back up protection; **(2)**

   (d) reverse power trip; **(2)**

   (e) short circuit. **(2)**

9. *(a)* Describe, with the aid of a diagram, the mode of operation of a *two step controller.* **(6)**

   (b) Explain how the addition of proportional and integral control will improve the action of the controller described in Q9*(a)*. **(4)**

10. *(a)* Sketch a labelled diagram of a basic pneumatic transmitter of the flapper/nozzle type incorporating feedback. **(8)**

    (b) Explain the purpose of feedback on a pnuematic transmitter. **(2)**

03-03

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. *(a)* Describe the problems associated with two dissimilar metals in contact in the presence of sea water. **(4)**

   (b) List THREE non-ferrous alloys that may be used in a vessel's sea water system, stating the alloying elements for EACH. **(6)**

2. *(a)* Describe TWO faults that may be observed on the surface of a weld, stating a possible cause for EACH. **(4)**

   (b) Describe THREE methods of non-destructive testing that may be used for the inspection of welds. **(6)**

3. *(a)* List FIVE fuel properties which are used in specifying a fuel oil. **(5)**

   (b) List FIVE impurities found in a fuel oil. **(5)**

4. *(a)* State TWO additives that may be added to a lubricating oil to provide additional benefits. **(2)**

   (b) Describe FOUR tests that can be used to establish the condition of an in-service lubricating oil. **(8)**

5. *(a)* Describe the indications of a leaking air start valve, stating how this may be detected. **(2)**

   (b) Describe FOUR possible causes of a leaking air start valve. **(4)**

   (c) Explain the opening periods of an air start valve. **(4)**

6. *(a)* Describe how a four-stroke engine may be started in the reverse direction. **(7)**

   (b) Explain the precautions that should be taken before an attempt is made to start the engine in the reverse direction. **(3)**

7. *(a)* Sketch a labelled, line diagram of an emergency switchboard arrangement showing the supplied circuits. **(7)**

   (b) Explain how main switchboard power is restored after a blackout. **(3)**

8. *(a)* List FIVE safety devices fitted to the main switchboard of a vessel. **(5)**

   (b) State a reason for fitting EACH of the devices listed in Q8*(a)* **(5)**

9. Explain, with the aid of sketches, the difference between *open loop* and *closed loop* control systems. **(10)**

10. *(a)* Explain what is meant by a differential pressure gauge. **(2)**

    (b) Describe TWO examples of differential pressure gauge, stating where these may be used in an engine room. **(8)**

01-03

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. *(a)* With reference to the characteristics of materials, explain EACH of the following terms:

   (i) ductility; **(2)**

   (ii) malleability. **(2)**

   (b) Sketch a typical load-extension diagram for mild steel, indicating the yield point, elastic limit and maximum load points. **(6)**

2. Explain EACH of the following terms:

   (a) austenitic stainless steel; **(2)**

   (b) aluminium bronze; **(2)**

   (c) brinelling; **(2)**

   (d) proof stress; **(2)**

   (e) atmospheric corrosion. **(2)**

3. *(a)* Describe FOUR shipboard tests that could be performed on an oil. **(8)**

   (b) State TWO procedures for maintaining fuel oil suitable for use. **(2)**

4. *(a)* State where a *strainer* and a *filter* may be fitted in a fuel oil system. **(2)**

   (b) Describe, with the aid of a sketch, the principle of conditioning an oil using a centrifuge. **(8)**

5. With reference to the operation of an air starting system of a large medium speed marine diesel engine fitted with individual air starting valves:

   (a) list FIVE precautions to be taken in the event of operating the engine with the running gear of one unit removed; **(5)**

   (b) explain the action to be taken if the engine in Q5*(a)* will not rotate for starting. **(5)**

6. *(a)* Sketch a labelled diagram of an air reservoir, indicating all mountings. **(8)**

   (b) State TWO methods by which the interior surface of a large air reservoir may be protected against corrosion. **(2)**

7. With reference to paralleling and load sharing of generators, explain EACH of the following:

   (a) the possible causes of no voltage indication on start up of a stand-by generator; **(2)**

   (b) the purpose of the check synchroniser; **(2)**

   (c) the reason for the incoming machine to be running slightly faster than the busbar frequency at the instant of closing the incoming breaker; **(2)**

   (d) how equal kW load sharing is maintained; **(2)**

   (e) why the power factors may be different even though the kW loads are equal. **(2)**

8. *(a)* Sketch a labelled diagram of an emergency battery system with charging from an a.c. supply, showing the means for automatic connection of the battery power to the emergency supply. **(8)**

   (b) Explain how the battery system sketched in Q8*(a)* is automatically connected to the emergency supply on loss of the main power. **(2)**

9. Sketch a labelled line diagram showing the components required to supply compressed air suitable for use as instrument control air. **(10)**

10. *(a)* Sketch a labelled diagram of a basic pneumatic three term controller of the flapper/nozzle type. **(8)**

    (b) Explain the purpose of feedback on a pneumatic transmitter. **(2)**

12-02

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. Explain EACH of the following terms:

   (a) stress raiser; (2)

   (b) tensile stress; (2)

   (c) compressive stress; (2)

   (d) sheer stress; (2)

   (e) Young's modulus. (2)

2. *(a)* Explain how steel is affected by its carbon content. (4)

   (b) Explain EACH of the following terms:

   (i) annealing; (2)
   (ii) normalising; (2)
   (iii) hardening. (2)

3. With reference to the properties of fuel oils, explain EACH of the following terms:

   (a) calorific value; (2)

   (b) ignition quality; (2)

   (c) residual carbon; (2)

   (d) sulphur content; (2)

   (e) specific gravity. (2)

12-02

4. *(a)* Explain what is meant by the flash point of a fuel oil, outlining the importance of the flash point value for the storage of fuel oils. (4)

   (b) Explain how the flash point of a lubricating oil may change in service. (2)

   (c) Explain why a fuel or lubricating oil is heated before treatment in a centrifugal separator. (4)

5. Describe FIVE types of approved stored energy starting systems suitable for an emergency diesel driven generator. (10)

6. As Chief Engineer Officer, write standing orders for the checks that should be carried out by the engine room staff if a large medium speed diesel engine fails to rotate on the application of starting air. (10)

7. Sketch a labelled diagram of a Direct-on-Line a.c. starter including the auxiliary circuit. (10)

8. *(a)* Outline FIVE safety precautions that need to be observed for the location and storage of a large bank of emergency batteries. (5)

   (b) List FIVE weekly routine maintenance tasks that need to be performed on a bank of lead acid battery cells. (5)

9. Explain EACH of the following terms:

   (a) two step control; (2)

   (b) three-term controller; (2)

   (c) integral action; (2)

   (d) derivative action; (2)

   (e) negative feedback. (2)

10. With reference to a main engine lubricating oil system, explain, with the aid of a sketch, the principle of a *closed loop* temperature control system. (10)

10-02

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each question are shown in brackets

1. *(a)* With reference to the characteristics of materials, explain EACH of the following terms:

   (i) ductility; (2)
   (ii) malleability. (2)

   (b) Sketch a typical load-extension diagram for mild steel, indicating the yield point, elastic limit and maximum load points. (6)

2. Explain each of the following terms:

   (a) galvanic corrosion; (2)

   (b) cavitation damage; (2)

   (c) erosion damage; (2)

   (d) stress corrosion; (2)

   (e) atmospheric corrosion. (2)

3. *(a)* State FOUR functions of lubricating oil. (4)

   (b) Explain why the lubricating oil of a trunk piston diesel engine will deteriorate in service. (2)

   (c) State TWO advantages and TWO disadvantages of using grease as a lubricant in a plain bearing. (4)

4. *(a)* Explain where a *strainer* and a *filter* may be fitted in a lubricating oil system. (2)

   (b) Describe EACH of the following filters:

   (i) simplex filter; (2)
   (ii) duplex filter; (2)
   (iii) by-pass filter; (2)
   (iv) full-flow filter (2)

10-02

5. With reference to the operation of an air starting system of a large medium speed marine diesel engine fitted with individual air starting valves:

   (a) list FIVE precautions to be taken in the event of operating the engine with the running gear of one unit removed; (5)

   (b) explain the action to be taken if the engine in Q5 (a) will not rotate for starting. (5)

6. *(a)* Sketch a labelled diagram of an air reservoir, indicating all mountings. (8)

   (b) Explain the purpose of a fusible plug fitted to the air reservoir. (2)

7. Describe FIVE safety devices that may be fitted to an a.c. induction motor and it's associated control gear to protect the motor against burnout. (10)

8. *(a)* Sketch a labelled diagram of an emergency battery system with charging from an a.c supply, showing the means for automatic connection of the battery power to the emergency supply. (8)

   (b) Explain how the battery system sketched in Q8(a) is automatically connected to the emergency supply on loss of the main power. (2)

9. Describe, with the aid of a diagram, how a venturi tube may be used to measure the flow in a pipe. (10)

10. *(a)* Sketch a labelled diagram of a basic pneumatic transmitter of the flapper/nozzle type incorporating feedback. (8)

    (b) Explain the purpose of feedback on a pneumatic transmitter. (2)