U.S.C.G. Merchant Marine Exam

Chief Engineer-MODU

Q750 General Subjects

(Sample Examination)
Choose the best answer to the following Multiple Choice Questions.

1. A hydraulic flow control circuit is shown in the illustration, and is known as a __________. Illustration GS-0107
   - (A) metered-out circuit
   - (B) bleed-off circuit
   - (C) metered-in circuit
   - (D) bleed-in circuit

   If choice B is selected set score to 1.

2. The function of item "7" shown in the illustration is to __________. Illustration GS-0153
   - (A) prevent separated oil from mixing with the incoming bilge water
   - (B) support the tank access panel
   - (C) allow the oil accumulated to exit the device, while remaining separated from the liquid
   - (D) direct the flow of the oily-water mixture against the coalescer bed

   If choice A is selected set score to 1.

3. As shown in the illustration, a section of standard weight, seamless steel pipe, has an external diameter of 4.0 inches. When the pipe, is bent into a 90 degree turn, the length of the outside edge of the curve "A-B" will exceed the length of the inside edge of the curve "C-D" by __________. Illustration GS-0108
   - (A) 1.05 inches
   - (B) 1.25 inches
   - (C) 2.67 inches
   - (D) 6.28 inches

   If choice D is selected set score to 1.

4. What is the length of the stud used to secure the packing gland shown in the illustration? Illustration GS-0012
   - (A) 1 inch
   - (B) 1 1/4 inches
   - (C) 1 1/2 inches
   - (D) 2 1/2 inches

   If choice D is selected set score to 1.
5. Where would you find a list of the firefighting equipment required on your vessel?
   - (A) Official logbook
   - (B) Muster List ("Station Bill")
   - (C) In the captain's desk
   - (D) Certificate of Inspection

   *If choice D is selected set score to 1.*

6. A dented race in an antifriction bearing could be caused by __________.
   - (A) abrasives in the lubricant
   - (B) water in the bearing
   - (C) vibration while the bearing is not in operation
   - (D) dirt in the bearing

   *If choice C is selected set score to 1.*

7. Which of the following statements describes the characteristics of precision manufactured roller bearings?
   - (A) They are well adapted to variable speed operation.
   - (B) They have a relatively high power loss due to friction.
   - (C) Their lubrication is complicated and requires constant attention.
   - (D) They are not capable of maintaining alignment over long periods of time.

   *If choice A is selected set score to 1.*

8. Which of the following statements is true concerning the application for an isochronous governor?
   - (A) An isochronous governor is ideally suited for a ship's geared propulsion drive driving through a fixed pitch propeller.
   - (B) An isochronous governor is ideally suited for a pump drive associated with maintaining a constant pump discharge pressure.
   - (C) An isochronous governor is ideally suited for a ship's direct-reversible propulsion drive driving through a fixed pitch propeller.
   - (D) An isochronous governor is ideally suited for a ship's service alternator drive associated with maintaining a constant system frequency.

   *If choice D is selected set score to 1.*
9. What statement is true concerning the door interlock devices associated with a winding drum or traction drive passenger elevator onboard ship?

- (A) Door interlocks are used to prevent elevator operation if the doors are still open and only allow elevator operation if the doors are proved closed.
  - (B) Door interlocks are used to over-ride elevator emergency status in a shipboard emergency when elevators are required to be used.
  - (C) Door interlocks are used to prevent elevator operation if the doors are still closed and only allow elevator operation if the doors are proved open.
  - (D) Door interlocks are used to prevent elevator operation in a shipboard emergency when elevators are not to be used.

*If choice A is selected set score to 1.*

10. Hydraulically, servo-operated, automatic, change over valves, utilized in a two ram hydraulic steering gear, serve to __________.

- (A) prevent either main pump from being hydraulically motored when idle by cross pressure flow
  - (B) allow an alternate main pump to start in the fully loaded condition thus developing immediate full torque
  - (C) prevent both units from operating simultaneously which could result in doubling the flow of oil and pressure leading to over pressurization of the system
  - (D) all of the above

*If choice A is selected set score to 1.*

11. How can the chance of contaminating hydraulic fluid be decreased when working on hydraulic systems?

- (A) Clean the fittings before they are disconnected.
  - (B) Place drip pans under leaky fittings.
  - (C) Seal any cracks in lines with Permatex.
  - (D) Coat all threads with graphite oil.

*If choice A is selected set score to 1.*

12. A hydraulic system gear pump being fed from a reservoir frequently indicates signs of excessive pitting after two months of service. Which of the following would most likely contribute to this condition?

- (A) A vacuum condition has developed in the reservoir.
  - (B) Operating oil temperature is determined to be below normal.
  - (C) A partial restriction in the return line has developed.
  - (D) Abnormal pressurization is occurring in the reservoir.

*If choice A is selected set score to 1.*
13. If oil under pressure is supplied to the area noted as "N" on the vane in the illustration __________.
   Illustration GS-0116
   - (A) "O" will be hydraulically locked in place even though oil is returned to the main pump from the
     area between "M" and "I"
   - (B) "O" will rotate clockwise as oil is returned from the area between "M" and "I"
   - (C) "O" will rotate counter-clockwise as oil is returned from the area between "M" and "I"
   - (D) "Q" will rotate counter-clockwise as oil is returned from the area between "M" and "I"
   
   *If choice C is selected set score to 1.*

14. To prevent shaft currents in an alternator, the outboard bearing shell or outboard bearing pedestal is
    insulated. If the methodology used is the insulated bearing pedestal, how is the pedestal insulation
    evaluated?

   - (A) Measuring the resistance between the bearing pedestal and the bearing bedplate of a
     disassembled machine with a digital multimeter setup as an ohmmeter.
   - (B) Measuring the resistance between the bearing pedestal and the bearing bedplate of an
     assembled machine with a digital multimeter setup as an ohmmeter.
   - (C) Measuring the resistance between the bearing pedestal and the bearing bedplate of an
     assembled machine with a 500-Volt megohmmeter.
   - (D) Measuring the resistance between the bearing pedestal and the bearing bedplate of a
     disassembled machine with a 500-Volt megohmmeter.

   *If choice D is selected set score to 1.*

15. As shown in the illustrated alternator protection scheme diagram, what device provides the input to
    the overcurrent inverse time relay "OCIT", the overcurrent instantaneous trip "OC (inst.)", and the
    negative phase sequence relay "NPS"? Illustration EL-0067

   - (A) thermal monitor sensors
   - (B) current transformer
   - (C) infrared sensors
   - (D) potential transformer

   *If choice B is selected set score to 1.*

16. Which of the following statements is true concerning the cleaning of electrical contacts?

   - (A) Compressed air should be used to blow out metallic dust.
   - (B) Magnetic brushes should be used to remove metallic dust.
   - (C) Delicate parts should be cleaned with a brush and an approved safety solvent.
   - (D) The contact surfaces should be greased to increase contact resistance.

   *If choice C is selected set score to 1.*
17. If the motor of the illustrated circuit fails to start and gives a loud hum when the start button is pushed, what is most likely the problem? Illustration EL-0007

- (A) the disconnect switch "DS" is open
- (B) an open overload "OL" heater
- (C) an open main contactor "M" coil
- (D) an open overload "OL" relay contact

*If choice B is selected set score to 1.*

18. Which of the following statements is true concerning a large polyphase synchronous main propulsion motor as used in an electric propulsion drive system?

- (A) Resistance is gradually added to the rotor circuit.
- (B) The motor is started as an induction motor.
- (C) The starting current is held below the rated current.
- (D) The field winding is energized for starting purposes only.

*If choice B is selected set score to 1.*

19. Which of the listed classes of electrical insulation is suited for the highest operating temperature?

- (A) Class 90 (O)
- (B) Class 105 (A)
- (C) Class 130 (B)
- (D) Class 180 (H)

*If choice D is selected set score to 1.*

20. In addition to short circuits and sustained overloads, in what other situation are fuses likely to blow?

- (A) loose fuse holder clips
- (B) oversized fuses in terms of amp rating
- (C) low ambient temperatures
- (D) low fuse holder clip to fuse contact resistance

*If choice A is selected set score to 1.*

21. Which of the procedures or conditions listed could result in damaging a transistor beyond repair?

- (A) Applying silicone grease between the heat sink and the transistor mounting.
- (B) Providing incorrect polarity to the collector circuit.
- (C) Installing a transistor whose current rating exceeds the design circuit current.
- (D) Providing insufficient voltage to the input circuit.

*If choice B is selected set score to 1.*
22. What problem with a printed circuit board may resolve itself once a board is removed from its edge card connector and then reinstalled?

- (A) Open traces or broken connections
- (B) Discolored or darkened components
- (C) Leaking components
- (D) Corroded pin connectors

*If choice D is selected set score to 1.*

23. What statement is true concerning temporary protective grounds used to establish an equipotential zone for the purposes of eliminating the electric shock hazard?

- (A) A shock hazard exists when there is no difference in potential between conductors or a conductor and hull ground.
- (B) A shock hazard exists only when there is a difference in potential between a conductor and hull ground.
- (C) A shock hazard exists when there is a difference in potential between conductors or a conductor and hull ground.
- (D) A shock hazard exists only when there is a difference in potential between conductors.

*If choice C is selected set score to 1.*

24. Before work may safely commence on a high voltage system, what must first be done after disconnection and isolation?

- (A) The circuit must be tested and proved dead first with a live-line tester, then grounded.
- (B) The circuit must be tested and proved dead first with an off-line tester, then grounded.
- (C) The circuit must be grounded first, then tested and proved dead with an off-line tester.
- (D) The circuit must be grounded first, then tested and proved dead with a live-line tester.

*If choice A is selected set score to 1.*

25. If a computer display is flickering, how may this be remedied?

- (A) Decrease the refresh rate
- (B) Increase the refresh rate
- (C) Decrease the resolution bandwidth
- (D) Increase the resolution bandwidth

*If choice B is selected set score to 1.*
26. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 15 degrees right rudder, assuming left rudder signals are negative and right order signals are positive in polarity? Illustration EL-0191

- (A) -1.33 VDC
- (B) -3.75 VDC
- (C) +3.75 VDC
- (D) +5.0 VDC

*If choice C is selected set score to 1.*

27. Referring to the illustration, suppose while in the oil separation processing mode, the oil content detector display screen shows 17.9 ppm and the oily-water separator is discharging back to the bilge water holding tank for recirculation. What is most likely the cause? Illustration GS-0175

- (A) The bilge water holding tank contents is excessively contaminated with oil.
- (B) The oily-water separator service pump is excessively worn.
- (C) The oily-water separator bilge suction strainer is excessively clogged.
- (D) The bilge water holding tank level is excessively high resulting in a high level alarm.

*If choice A is selected set score to 1.*

28. According to the illustration, which of the following conditions would most likely cause Pump "A" to short cycle? Illustration GS-0173

- (A) The hydro-pneumatic expansion tank is operating with an insufficient air charge.
- (B) The hydro-pneumatic tank is operating with a low water level.
- (C) A low water level exists in the potable water storage tank.
- (D) Pump "A" wearing rings have excessive clearance.

*If choice A is selected set score to 1.*

29. In a closed-loop process control system, what is meant by the proportional mode of control?

- (A) It is a control mode that produces a control action that is proportional to the error.
- (B) It is a control mode that produces a control action that is proportional to the gain.
- (C) It is a control mode that produces a control action that is proportional to the rate at which the error is changing.
- (D) It is a control mode that produces a control action that is proportional to the accumulation of error over time.

*If choice A is selected set score to 1.*
30. In a closed-loop process control system, what term is used to describe the action of measuring the difference between the actual result and the desired result and using that difference to drive the actual result toward the desired result?

- (A) Deadband
- (B) Feedback
- (C) Instability
- (D) Gain

*If choice B is selected set score to 1.*

31. When tuning a proportional-integral-derivative (PID) controller/loop, one should know/understand the influence of each action component on the loop. Which description of a component is correct?

- (A) Integral - component in which the input is proportional to the output.
- (B) Proportional - component in which there is a linear relationship between output and input.
- (C) Proportional - component in which there is a linear relationship between setpoint and input.
- (D) Derivative - component in which the input is proportional to the rate of change of the output.

*If choice B is selected set score to 1.*

32. In an air conditioning system, what is the name of the chamber where the duct-work originates?

- (A) intake chamber
- (B) plenum chamber
- (C) vapor chamber
- (D) exhaust chamber

*If choice B is selected set score to 1.*

33. A room humidistat initiates the lowering of the humidity of the conditioned supply air to a space, while the actual process is accomplished by what means?

- (A) lowering both the cooling coil temperature and the reheater temperature
- (B) raising both the cooling coil temperature and the reheater temperature
- (C) lowering the cooling coil temperature and raising the reheater temperature
- (D) raising the cooling coil temperature and lowering the reheater temperature

*If choice C is selected set score to 1.*

34. When pumping down an air conditioning system to test the low-pressure cutout switch, assuming that the compressor is running, what should be done to initiate the test?

- (A) stop the compressor
- (B) close the “king” valve
- (C) secure the condenser
- (D) stop the circulating pump

*If choice B is selected set score to 1.*
35. Personnel servicing refrigeration systems that exposes them to commonly used refrigerants should wear what type of personal protective equipment?

- (A) an all-purpose gas mask
- (B) goggles and gloves
- (C) rubber soled shoes
- (D) a respirator

*If choice B is selected set score to 1.*

36. When one belt of a multiple V-belt drive requires replacing, what will be required?

- (A) ensure the seasoned belts are reinstalled in their proper sequence
- (B) ensure the proper belt dressing is applied
- (C) replace the entire belt set
- (D) season the new belt prior to installation

*If choice C is selected set score to 1.*

37. A reciprocating refrigeration compressor may be tested for leaking discharge valves by stopping the compressor, turning the discharge service valve all the way in, and then turning the compressor over by hand. If the discharge valves are leaking, the compound gage will show pressures which react in which way?

- (A) decreasing with each stroke
- (B) rising and falling with each stroke
- (C) increasing with each stroke
- (D) decreasing to a vacuum

*If choice B is selected set score to 1.*

38. A refrigeration compressor used in a multi-box refrigeration system, is designed with six of its eight cylinders able to be controlled for variable load conditions. If all of the reefer boxes are currently feeding, what percentage of the total number of compressor cylinders will be loaded after start up?

- (A) 100%
- (B) 50%
- (C) 25%
- (D) 0%

*If choice A is selected set score to 1.*
39. If the superheat value of the thermostatic expansion valve is adjusted too high, what would be the result?
   - (A) the heat removal capacity of the evaporator will increase
   - (B) the suction line of the compressor will be abnormally warm
   - (C) the evaporator will be overfed with liquid refrigerant
   - (D) the suction line of the compressor will be abnormally cold

   If choice B is selected set score to 1.

40. With regards to shipboard refrigeration systems, after July 1, 1992, what action became illegal?
   - (A) mixing R-12 and R-22
   - (B) producing a class I refrigerant
   - (C) working on a refrigeration system without permission of the Officer in Charge Marine Inspection
   - (D) intentionally venting class I or II refrigerants to the atmosphere

   If choice D is selected set score to 1.

41. When opening or closing compressor service and line isolation valves on a typical refrigeration system that is fitted with packed valves, what must you do?
   - (A) you should replace the gasket each time the valve position is changed
   - (B) you should never loosen or tighten the packing gland
   - (C) you must first remove the stem seal cap
   - (D) you should turn valves slowly to avoid thermal stresses due to low temperatures

   If choice C is selected set score to 1.

42. In order to establish a good climate for communication it is important to minimize status barriers. Which of the following techniques would be the best way to minimize status barriers on a one-on-one, face-to-face conversation of a sensitive nature with an employee?
   - (A) Conversing with the employee in your office with the employee sitting on the opposite side of the desk from you.
   - (B) Conversing with the employee in the ship’s office with the employee sitting on the opposite side of the desk from you.
   - (C) Conversing with the employee in his/her workspace or a neutral area without regard to being interrupted.
   - (D) Conversing with the employee in his/her workspace or a neutral area with privacy assured.

   If choice D is selected set score to 1.
43. The design of a job has a great impact on whether or not the job itself is motivating. One of the characteristics of a job design is skill variety, which is the extent to which a job requires a worker to use a broad range of skills and talents to perform the job successfully. What is true about skill variety?

- (A) Generally, the greater the variety of the skills that are performed, the greater the level of intrinsic motivation.
- (B) Generally, the greater the variety of the skills that are performed, the lower the level of intrinsic motivation.
- (C) Generally, the greater the variety of the skills that are performed, the greater the level of extrinsic motivation.
- (D) Generally, the greater the variety of the skills that are performed, the lower the level of extrinsic motivation.

If choice A is selected set score to 1.

44. What leadership style tends to extrinsically motivate employees on a contingent reward system where the focus is on outcomes?

- (A) Developmental leadership
- (B) Transactional leadership
- (C) Adaptive leadership
- (D) Transformational leadership

If choice B is selected set score to 1.

45. During the "forming" stage of group development, members are trying to determine the task of the group and their role expectations of one another. As a manager, what should be done to help facilitate the "forming" process?

- (A) The group members should be similar in background regardless of the degree of complexity of the task.
- (B) The group members should be widely differing in background regardless of the degree of complexity of the task.
- (C) The group should not have a designated leader to promote equality.
- (D) The group should have a designated leader to provide structure and guidance.

If choice D is selected set score to 1.

46. Which of the following conflict resolution techniques represents a strategy where everyone wins?

- (A) Joint problem solving by both sides.
- (B) Struggle and victory of one side over the other.
- (C) Voluntary submission of one side.
- (D) Compromise by both sides.

If choice A is selected set score to 1.
47. As a manager considering which approach to use at a meeting, what type of meeting is most likely to
be one that is most appropriate to use a leader-controlled approach as opposed to a group-centered
approach?

- (A) Information exchange meeting
- (B) Problem-solving meeting
- (C) Information-giving meeting
- (D) Fact-finding meeting

*If choice C is selected set score to 1.*

48. When planning for a fire and emergency drill, the crew should be motivated and challenged to do
their very best. What type of simulation promotes this level of motivation and meeting the challenge?

- (A) Choosing an often-repeated scenario with which the crew is very familiar.
- (B) Choosing an often-repeated scenario associated with a low fire risk area.
- (C) Choosing a scenario representing a low fire risk in terms of flammables.
- (D) Choosing a realistic scenario representing a high fire risk in terms of flammables.

*If choice D is selected set score to 1.*

49. Which of the following comprehensive computerized maintenance system database modules would
contain data such as part numbers and part stowage locations?

- (A) Requisitions management module
- (B) Inventory management module
- (C) Equipment management module
- (D) Planned maintenance management module

*If choice B is selected set score to 1.*

50. Which of the following condition-based maintenance data continuous monitoring techniques has the
greatest value in predicting wear?

- (A) Vibration analysis
- (B) Thermography
- (C) Lubricating oil analysis
- (D) Acoustic analysis

*If choice A is selected set score to 1.*
51. Which of the following would be a positive outcome associated with performing a trend analysis of data acquired from lube oil testing, vibration sensors, performance data sensors, and thermographic sensors?

I) Avoidance of catastrophic failures.
II) Determining the need of when to perform corrective maintenance.
III) Improving the overall effectiveness of the engineering plant.

- (A) I only.
- (B) II only.
- (C) I and II only.
- (D) I, II, and III.

*If choice D is selected set score to 1.*

52. As a management level engineering officer, you are apt to be the primary investigator investigating the root cause of the failure of a piece of machinery. Besides collecting and preserving the physical evidence of the failure and interviewing key personnel, which of the following supplemental information should be considered?

I) Onboard operating and maintenance procedures
II) Historical operating and maintenance records
III) Technical manuals and specifications
IV) Personnel training records

- (A) I, II, and III only.
- (B) I, III, and IV only.
- (C) II, III, and IV only.
- (D) I, II, III, and IV.

*If choice D is selected set score to 1.*

53. If it is desired to perform a thermographic analysis of new equipment to gain a thermal signature for purposes of comparison to the thermal signature for the same equipment at a later date, what is the name of the thermography performed on the equipment when new?

- (A) Comparative thermography.
- (B) Thermal trending.
- (C) Baseline thermography.
- (D) Spectral thermography.

*If choice C is selected set score to 1.*
54. According to the 46 CFR regulations applicable to tests, drills, and inspections for mobile offshore drilling unit operations, for a self-propelled MODU, how often must the steering gear, whistle, general alarm bells, and communications between the bridge or control room and the engine room be tested while the MODU is on station?

- (A) At least daily
- (B) At least once each week
- (C) At least once each month
- (D) At least once each quarter

If choice B is selected set score to 1.

55. In accordance with 33 CFR Subchapter O (Pollution), how long must the Oil Record Book be maintained on board those vessels for which the regulations apply?

- (A) 1 year at a minimum.
- (B) 2 years at a minimum.
- (C) 3 years at a minimum.
- (D) 4 years at a minimum.

If choice C is selected set score to 1.

56. One of the means of alternative dispute resolution regarding a collective bargaining agreement is arbitration. What is the role of the arbitrator?

- (A) The arbitrator conducts independent fact-finding and renders a decision based on the results of that investigation.
- (B) The arbitrator facilitates settlement by negotiation by working with both sides to reach common ground.
- (C) The arbitrator makes a binding decision based on the evidence and the arguments presented by both sides.
- (D) The arbitrator appoints a fact-finder from each side to investigate the dispute and report back to the principals.

If choice C is selected set score to 1.

57. If there is any doubt that a newly employed engine department crew member is sufficiently familiar with the engine room equipment, operating and maintenance procedures needed for the proper performance of his or her duties, what should be done?

- (A) The employee should be immediately terminated and arrangements made for a relief to be sent out whenever practical.
- (B) The employee should be provided a period of close supervision until there is no longer any doubt that he or she is familiar enough to be competent.
- (C) The employee should be demoted and required to function at the lowest level for the entire duration of his or her assignment.
- (D) The employee should be allowed to perform his or her duties without supervision in the hopes that he or she will eventually become familiar enough to be competent.

If choice B is selected set score to 1.
58. In consultation with the other ship’s management level officers, you are planning a required fire emergency drill. In addition to selecting a scenario as functionally realistic as possible (such as a high fire risk area) what follow-up activity would best maximize the training effectiveness for future applicability to an actual fire emergency?

- (A) Document the fire drill training as required to authenticate proof of training.
- (B) Debrief the entire crew after the drill to critique what went right and what went wrong.
- (C) Hold a post-drill conference among the management officers to discuss the drill.
- (D) Write up a critique of the fire drill and distribute to shore side management.

*If choice B is selected set score to 1.*

59. As Chief Engineer you join a vessel enrolled in Continuous Machinery Survey. Approximately what percent of the machinery should be surveyed per year throughout the Special Survey cycle?

- (A) 10%
- (B) 20%
- (C) 25%
- (D) 50%

*If choice B is selected set score to 1.*

60. There are many tasks to carry out prior to and during bunkering. What is the best way to insure no task is missed?

- (A) Use of the certificate of inspection.
- (B) Use of a bunkering safety checklist.
- (C) Use of the declaration of inspection.
- (D) Use of the vessel oil pollution response plan.

*If choice B is selected set score to 1.*

61. What maintenance may be carried out on a thermostatic expansion valve?

- (A) The proportional action may be varied.
- (B) The rate action may be increased.
- (C) The thermal bulb may be recharged.
- (D) The inlet screen may be cleaned.

*If choice D is selected set score to 1.*

62. Through which of the components shown in the illustration is flash gas formation a normal occurrence? Illustration GS-RA-25

- (A) evaporator coil
- (B) receiver tank
- (C) condenser coil
- (D) thermostatic expansion valve

*If choice D is selected set score to 1.*
63. What statement is true concerning assessment validity and assessment reliability?

- (A) Assessment reliability is not a pre-condition for assessment validity, and assessment validity is not a pre-condition for assessment reliability.
- (B) Assessment reliability is a pre-condition for assessment validity, and assessment validity is a pre-condition for assessment reliability.
- (C) Assessment reliability is a pre-condition for assessment validity, but not vice versa.
- (D) Assessment validity is a pre-condition for assessment reliability, but not vice versa.

*If choice A is selected set score to 1.*

64. In the illustrated motor controller, what do the contacts across terminals "3" and "4" of the control circuit represent? Illustration EL-0017

- (A) thermal overload heater
- (B) normally closed overload relay contact
- (C) magnetic overload coil
- (D) normally open overload relay contact

*If choice B is selected set score to 1.*

65. What type of motor is generally used in DC propulsion drive systems?

- (A) differentially compounded
- (B) series wound
- (C) permanent magnet
- (D) shunt wound

*If choice D is selected set score to 1.*

66. On a digital numerical display readout, what would be the minimum number of LED segments required to form and display any digit 0 through 9?

- (A) 6
- (B) 7
- (C) 8
- (D) 9

*If choice B is selected set score to 1.*
67. As shown in the illustrated block diagram for a digitized echo sounding system, what statement is true concerning the function of the transducer? Illustration EL-0185

- (A) The transducer converts radio frequency (RF) electromagnetic energy to acoustic energy while receiving and converts the reflected acoustic energy back into RF electromagnetic energy while transmitting.
- (B) The transducer converts radio frequency (RF) electromagnetic energy to acoustic energy while transmitting and converts the reflected acoustic energy back into RF electromagnetic energy while receiving.
- (C) The transducer converts audio frequency (AF) electromagnetic energy to acoustic energy while receiving and converts the reflected acoustic energy back into AF electromagnetic energy while transmitting.
- (D) The transducer converts audio frequency (AF) electromagnetic energy to acoustic energy while transmitting and converts the reflected acoustic energy back into AF electromagnetic energy while receiving.

*If choice B is selected set score to 1.*

68. What is the most common and reliable type of circuit breaker used for high voltage practice aboard ship?

- (A) oil-break
- (B) gas-break
- (C) air-break
- (D) vacuum-break

*If choice D is selected set score to 1.*

69. Without the benefit of a specially designed enclosure window for thermographic analysis, what must be done to obtain accurate, but safe readings using infrared thermographic techniques?

- (A) The infrared camera recording is taken before de-energizing and isolating in accordance with safety procedures.
- (B) The infrared camera recording is taken while energized with the enclosure door open in accordance with safety procedures.
- (C) The infrared camera recording is taken immediately after de-energizing and isolating in accordance with safety procedures.
- (D) The infrared camera recording is taken after waiting a suitable period of time after de-energizing and isolating in accordance with safety procedures.

*If choice C is selected set score to 1.*
70. If an 8-bit digital to analog converter (DAC) produces an analog output voltage with a range of 10 volts (0-9 volts), what is the smallest incremental step in voltage that can be generated at the output?

- (A) 0.03 volts
- (B) 0.04 volts
- (C) 0.625 volts
- (D) 1.25 volts

*If choice B is selected set score to 1.*
EL-0185
Digitized Echo Sounding System
Adaptive Digital Steering Control System Functional Block Diagram

Adaptive Digital Steering System Interface Signals

<table>
<thead>
<tr>
<th>Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed log input</strong></td>
<td></td>
</tr>
<tr>
<td>Pulsed</td>
<td>200 pulse nautical mile (PPNMI) format (contact closure)</td>
</tr>
<tr>
<td>Serial</td>
<td>RS-232 (channel A or C) or RS-422 (channel B) communications in NMEA 0183 format, $VBW, $VHW</td>
</tr>
<tr>
<td><strong>Navigator (vessel management system) input</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serial data for heading order, rate order, and cross track error information in RS-232 or RS-422 communication on channel A, B or C, in NMEA format $APB, $HSC, $HTR, $HTC or $XTE</td>
</tr>
<tr>
<td><strong>Compass</strong></td>
<td></td>
</tr>
<tr>
<td>Step data</td>
<td>Positive or negative step data (24 or 70 V)</td>
</tr>
<tr>
<td>Syncro</td>
<td>1X, 90X or 360X</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td></td>
</tr>
<tr>
<td>Serial data</td>
<td>$HDT (on channels A, B or C)</td>
</tr>
<tr>
<td><strong>Mode switch sense contact</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External switched opened or closed to inform autopilot to change from Standby mode to an automatic mode</td>
</tr>
<tr>
<td><strong>NFU sense contacts</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External contacts to indicate when the NFU Controller is active</td>
</tr>
<tr>
<td><strong>Power failure circuits</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Closed contacts on external power switch to activate power failure alarm</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
</tr>
<tr>
<td>Interface to external rudder servo control amplifiers</td>
<td>Bipolar analogue voltage proportional to the rudder order: $± 11.25$ V (maximum limit) equal to $± 45^\circ$ or rudder</td>
</tr>
<tr>
<td>Rate of turn interface</td>
<td>Bipolar analogue voltage proportional to a turn rate indicator: $± 4.5$ V (Max) equal to $± 90^\circ$ turn/min. Resolution equal to $0.5^\circ$/min.</td>
</tr>
</tbody>
</table>
Note: Inside dia. of Wearing Ring, PC No. (4) is .020 undersize outside dia. of Wearing Ring, PC No. (6) is .020 oversize when finished as repair parts and are designated as part No. 5 A3H180A-1 U/S and 3H180-1 O/S

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
<th>REMARKS</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Impeller</td>
<td>NI-CU Alloy</td>
<td>3H1A</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Volute</td>
<td>Gunmetal</td>
<td>3H4C</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Suction Cover</td>
<td>Gunmetal</td>
<td>3H193</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Volute Wear Ring</td>
<td>Valve Bronze</td>
<td>A-3H180A</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Volute Gasket</td>
<td>Asbestos</td>
<td>P/N 3H37</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Impeller Wear Ring</td>
<td>NI-CU Alloy</td>
<td>3H180</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>Motor Bracket</td>
<td>Cast Steel</td>
<td>2L3C</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>Shaft Sleeve</td>
<td>NI-CU Alloy</td>
<td>P/N A-014-20A-0-01</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Throat Bushing</td>
<td>NI-CU Alloy</td>
<td>P/N 4L26-4</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>Lantern Ring</td>
<td>NI-CU Alloy</td>
<td>4L169</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>Gland Half</td>
<td>Bronze</td>
<td>B-017-5AH-A</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>Slinger</td>
<td>Neoprene</td>
<td>1 47/64 X 3 3/4 X 1/8TH</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>Impeller Washer</td>
<td>NI-CU Alloy</td>
<td>17/32 X 9/16 X 3/16TH</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>Impeller Key</td>
<td>NI-CU Alloy</td>
<td>1/4 SQ X 2 5/16 TH</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>SKT HD Capscrew</td>
<td>SST</td>
<td>1/2-13 NC X 1/4 LG NYLOCK</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>Packing Rings</td>
<td>Plastic Metallic</td>
<td>1 3/4 X 2 5/8 X 7/16 SQ</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>Name Plate</td>
<td>Brass</td>
<td>P/N A-226-00N0-0-03</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td>Hex Head Capscrews</td>
<td>NI-CU Alloy</td>
<td>1/2-13 NC X 1 LG</td>
</tr>
<tr>
<td>19</td>
<td>4</td>
<td>Hex Head Capscrews</td>
<td>NI-CU Alloy</td>
<td>3/8-16 X 1 LG</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>Hex Head Capscrews</td>
<td>NI-CU Alloy</td>
<td>1/2-13 NC X 1 1/4 LG</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>Stud</td>
<td>SST</td>
<td>3/8-16 NC X 2 1/2 LG</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>Hex Nut</td>
<td>Bronze</td>
<td>3/16-16 2</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
<td>Setscrew</td>
<td>NI-CU Alloy</td>
<td>10-24 NC X 1/4 LG CUP</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
<td>Setscrew</td>
<td>NI-CU Alloy</td>
<td>10-24 NC X 1/4 LG CUP</td>
</tr>
<tr>
<td>25</td>
<td>4</td>
<td>Drive Screw</td>
<td>Brass</td>
<td>6-24 X 1/4 LG</td>
</tr>
<tr>
<td>26</td>
<td>3</td>
<td>Pipe Plug</td>
<td>Bronze</td>
<td>1/4 NPT</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>Vent Valve</td>
<td>Bronze</td>
<td>1/4 NPT</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>O Ring</td>
<td>Buna &quot;N&quot;</td>
<td>1 5/16 ID 1/16 WIDE</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>Pipe</td>
<td>70-30 CU-NI</td>
<td>4 11/16 LG 1/4 NPT</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>Pipe</td>
<td>70-30 CU-NI</td>
<td>3 3/16 LG 1/4 NPT</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>Flange</td>
<td>Valve Bronze</td>
<td>1/4 INCH 150#</td>
</tr>
</tbody>
</table>