U.S.C.G. Merchant Marine Exam

Assistant Engineer-Limited

Q612 Gas Turbine Plants

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

1. The gas generating sections of marine gas turbine engines are based on which of the following?
   - (A) Aircraft jet engines.
   - (B) Free piston engines.
   - (C) Radial piston engines.
   - (D) Oil-fired auxiliary boilers.

   If choice A is selected set score to 1.

2. In a gas turbine, the air charge is permitted to be compressed adiabatically by what factor, process, or condition?
   - (A) Speed of the process
   - (B) Low-compression ratio
   - (C) Interstage cooling
   - (D) Rapid heat transfer

   If choice A is selected set score to 1.

3. An open cycle gas turbine engine is best described by which of the following statements?
   - (A) Working fluids are taken in, transformed, and then discarded.
   - (B) Energy is neither created nor destroyed and the cycle is therefore perpetual.
   - (C) Working fluids are taken in, transformed, and then recuperated.
   - (D) Energy is added externally.

   If choice A is selected set score to 1.

4. Why is the cycle efficiency higher in the intercooled-recuperated cycle as compared to a simple cycle gas turbine? Illustration GT-0026
   - (A) The intercooler serves to increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to increase turbine inlet temperature.
   - (B) The intercooler serves to reduce the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease turbine inlet temperature.
   - (C) The intercooler serves to reduce the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease required fuel to achieve the turbine inlet temperature.
   - (D) The intercooler serves to increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease turbine inlet temperature.

   If choice C is selected set score to 1.
5. The acronym MFC represents which of the following?

- (A) Manifold fuel control.
- (B) Midframe compressor.
- (C) Main fuel control.
- (D) Maritime fuel congress.

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

6. The acronym FOD stands for which of the following?

- (A) Fuel override demand.
- (B) Foreign object damage.
- (C) Fuel oil discharge.
- (D) Flow offset design.

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

7. Power is defined as which of the following?

- (A) Work performed through a distance.
- (B) The rate of applying a force.
- (C) The rate of doing work.
- (D) Force applied through a distance.

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

8. Mechanical work is defined as which of the following?

- (A) A force acting through a distance.
- (B) Distance traveled over time.
- (C) Rate of doing work.
- (D) A measurement in pounds per square inch.

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

9. What is the term given to a process that occurs without a loss or gain of heat?

- (A) Isothermal
- (B) Endothermic.
- (C) Adiabatic
- (D) Exothermic.

*If choice C is selected set score to 1.*
10. Thermal energy is the only form of energy that can be added to or removed from a substance. How is thermal energy that is added to a substance stored?

- (A) In the form of potential kinetic energy.
- (B) In the form of internal energy.
- (C) In the form of heat.
- (D) In the form of mechanical energy.

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

11. Under standard atmospheric conditions, 208.7 PSIG converts to approximately what in absolute pressure?

- (A) 214.7 PSIA
- (B) 194.0 PSIA
- (C) 223.4 PSIA
- (D) 104.7 PSIA

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

12. A temperature of 69.5 degrees Fahrenheit converts to approximately what temperature in degrees Rankine?

- (A) 203.5 degrees R.
- (B) 590.5 degrees R.
- (C) 529.5 degrees R.
- (D) 342.5 degrees R.

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

13. A centrifugal compressor assembly consists of which of the following?

- (A) Rotating pistons and stationary liners.
- (B) A rotating impeller and a stationary diffuser.
- (C) A stationary impeller and a rotating diffuser.
- (D) Stationary vanes and rotating blades.

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

14. While air is being compressed in a centrifugal flow gas turbine, what happens to the direction of air flow?

- (A) Changes only at the compressor inlet.
- (B) Changes only at the compressor discharge.
- (C) Changes only once from inlet to outlet.
- (D) Changes at each separate component.

*If choice D is selected set score to 1.*
15. An axial compressor basically consists of which of the following?
   
   ○ (A) A stationary impeller and a rotating diffuser.
   ○ (B) Stationary vanes and rotating blades.
   ○ (C) A rotating impeller and a stationary diffuser.
   ○ (D) Rotating pistons and stationary liners.

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

16. Which of the following is the main advantage of a split-axial compressor case?

   ○ (A) Easier to repair and inspect.
   ○ (B) Cheaper to manufacture.
   ○ (C) Stronger construction.
   ○ (D) Simpler to disassemble.

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

17. What is the term used to describe the stationary vanes preceding the first stage of an axial compressor?

   ○ (A) Inlet guide vanes.
   ○ (B) Variable inlet vanes.
   ○ (C) Variable stator vanes.
   ○ (D) First stage stator vanes.

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

18. Two functions of the compressor stator vanes include which of the following?

   ○ (A) Direct air flow to rotor blades at the correct angle and are shaped to cause a velocity increase and a pressure decrease.
   ○ (B) Direct air flow to each rotor stage at the correct angle and deliver air to the combustor at the correct velocity and pressure.
   ○ (C) Direct air flow to rotor blades at the correct angle and are shaped to maintain a constant velocity and produce a pressure increase.
   ○ (D) Direct air flow to rotor blades at the correct angle and are shaped to produce a velocity increase and maintain a constant pressure.

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

19. What is a compressor midspan shroud?

   ○ (A) A support for the tips of the stator blades.
   ○ (B) A brace built into the middle of a rotor blade for damping.
   ○ (C) The center of a two-piece rotor blade.
   ○ (D) A method of securing stator blades.

   *If choice B is selected set score to 1.*
20. Which of the following statements is true concerning axial compressor disk-type rotors?

   o (A) Rotor discs are held together by through bolts.
   • (B) Rotor discs are shrunk fit onto a steel shaft.
   o (C) Rotor is only suitable for low-speed compressors.
   o (D) Rotor consists of rings that are flanged to fit one against the other.

   *If choice B is selected set score to 1.

21. In a gas turbine engine, the majority of the energy is added to the working fluid in which of the following components?

   o (A) Power turbine.
   o (B) High-pressure turbine.
   • (C) Combustor.
   o (D) Compressor.

   *If choice C is selected set score to 1.

22. The three most common types of combustors used in gas turbine engines are which of the following?

   o (A) can, vortex, and can-vortex.
   o (B) can, angular, and can-angular.
   o (C) can, derivative, and can-derivative.
   • (D) can, annular, and can-annular.

   *If choice D is selected set score to 1.

23. A turbine stage is represented by which of the following components and in which order?

   • (A) One set of stationary vanes, one set of rotating blades.
   o (B) One set of rotating blades, one set of stationary vanes.
   o (C) Two sets of stationary vanes, one set of rotating blades.
   o (D) One set of rotating vanes, one set of stationary blades.

   *If choice A is selected set score to 1.

24. The turbine nozzles convert heat and pressure energy to velocity energy by means of which of the following?

   o (A) Convergent-Divergent process.
   • (B) Convergent process.
   o (C) Divergent process.
   o (D) Deflection process.

   *If choice B is selected set score to 1.
25. The turbine nozzle blades convert the combustion gases heat and pressure energy into what form of energy?

- (A) Kinetic
- (B) Chemical
- (C) Electrical
- (D) Thermal

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

26. The circle of turbine stationary vanes that convert pressure and thermal energy to velocity energy and direct the combustion gases in the direction of turbine wheel rotation is referred to as what?

- (A) Compressor assembly.
- (B) Diffuser assembly.
- (C) Nozzle assembly.
- (D) Rotor assembly.

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

27. Which of the following designs is the most satisfactory method for attaching turbine blades to the rotor disk?

- (A) Pinning design.
- (B) Fir-tree design.
- (C) Locking tab design.
- (D) Retaining ring design.

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

28. Turbine disks are commonly attached to the shaft by which of the following methods?

- (A) Pinned or locking tabs.
- (B) Bolted or welded.
- (C) Riveted or pinned.
- (D) Locking tabs or retaining rings.

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

29. Which of the following is an advantage of a single-shaft gas turbine engine compared to a split-shaft gas turbine engine?

- (A) Better fuel economy
- (B) Fewer moving parts
- (C) Lower starting torque
- (D) Reversible

*If choice B is selected set score to 1.*
30. What type of air seal is used in the sump and turbine areas of a gas turbine engine?

- (A) Labyrinth-Honeycomb
  - (B) Fishmouth
  - (C) Pneumatic carbon ring
  - (D) Lip-type

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

31. What type of air seal is used in the combustor and turbine midframe of a gas turbine?

- (A) Fishmouth
  - (B) Lip-type
  - (C) Labyrinth-Honeycomb
  - (D) Pneumatic carbon ring

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

32. What type of engine starter motor is commonly found on the marine gas turbine shown in the illustration? Illustration GT-0006

- (A) DC series wound electric motor
- (B) AC synchronous motor
- (C) Hydraulic motor
- (D) AC induction motor

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

33. Accelerating the compressor to the self-sustaining speed of the engine is the function of which of the following components?

- (A) Compressor extension shaft
- (B) Mechanical drive shaft
- (C) Starter
- (D) PT shaft

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

34. In the ignition system of a gas turbine engine, how is optimum spark achieved?

- (A) Concentration of maximum energy in maximum time
- (B) Concentration of maximum energy in minimum time
- (C) Concentration of minimum energy in maximum time
- (D) Concentration of minimum energy in minimum time

*If choice B is selected set score to 1.*
35. The electrostatic vent fog precipitator removes oil mist from which of the following areas?

- (A) Main reduction gear
  - (B) Gas turbine engine
  - (C) Synchronous self-shifting clutch
  - (D) Lube oil storage tank

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

36. How is the lube oil supplied to each bearing in a gas turbine engine controlled?

- (A) Flow divider.
  - (B) Lube oil pump.
  - (C) Calibrated orifice.
  - (D) Regulating valve.

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

37. The main lubrication system utilized by the gas turbine engine shown in the illustration is what type? Illustration GT-0017

- (A) Common drain sump
  - (B) Oil mist recovery sump
  - (C) Dry sump
  - (D) Wet sump

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

38. As shown in the illustration, what is the purpose of pressurizing the main bearing lube oil sumps on a typical marine gas turbine? Illustration GT-0023

- (A) Increases lube oil penetration.
  - (B) Provides uniform lube oil distribution around the bearing.
  - (C) Assists in cooling the lube oil.
  - (D) Minimizes oil leakage from the rotor shaft.

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

39. Air used to cool the combustion liners and turbine components is referred to as which of the following?

- (A) Control air.
  - (B) Primary air.
  - (C) Secondary air.
  - (D) None of the above.

*If choice C is selected set score to 1.*
40. The fuel oil system of a gas turbine engine provides all EXCEPT which of the following?

- (A) Acts as a cooling medium for the lube oil cooler
- (B) Acts as a hydraulic medium to actuate the fuel control
- (C) Provides accurately metered fuel for combustion
- (D) Controls the angle of the variable stator vanes

If choice A is selected set score to 1.

41. How is the clutch shown in the attached illustration engaged? Illustration GT-0018

- (A) Clutch is engaged manually prior to start up.
- (B) Clutch engages automatically when input shaft flange is rotating faster than the output assembly.
- (C) Pneumatic pressure from the compressor engages the clutch.
- (D) Clutch engages automatically once the output assembly begins rotating.

If choice B is selected set score to 1.

42. Which of the following statements is true about the "lockout control" on a synchronous self-shifting (SSS) clutch?

- (A) It is an automatically operated control.
- (B) Permits operation of the GTE without the rotation of the main reduction gear.
- (C) The mechanism is incorporated into the input assembly of the clutch.
- (D) None of the above.

If choice B is selected set score to 1.

43. What type of main reduction gear arrangement prevents independent axial and rotational movement of the pinions?

- (A) Hydraulic suspension
- (B) Locked train
- (C) Independent suspension
- (D) Unlocked train

If choice B is selected set score to 1.

44. What feature is commonly used on articulated reduction gear arrangements for the correction of misalignment between the 1st reduction gear and the 2nd reduction pinions?

- (A) Fixed block pads.
- (B) Locked train shims.
- (C) Torsion pads.
- (D) Quill shafts.

If choice D is selected set score to 1.
45. What is the purpose of the Controllable-Pitch Propeller (CPP) hydraulic oil power system?

- (A) Supplies high-pressure oil for blade actuation and control oil for propeller pitch control.
  - (B) Supplies low-pressure oil for both pitch control and stern tube sealing.
  - (C) Supplies high-pressure oil for both propeller blade actuation and stern tube sealing.
  - (D) Supplies low-pressure oil for propeller blade actuation and control oil for propeller pitch control.

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

46. A magnet pickup typically produces what type of signal output?

- (A) steady DC voltage
  - (B) voltage pulse
  - (C) high current
  - (D) pure sine wave

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

47. Compressor characteristics are normally summarized in the form of which of the following?

- (A) Venn diagram.
  - (B) Straight line graph.
  - (C) Compressor map.
  - (D) Spread sheet.

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

48. Which of the following is NOT a gas turbine auto shutdown parameter?

- (A) High exhaust gas temperature.
- (B) Power turbine over speed.
  - (C) High compressor discharge pressure.
- (D) Module enclosure fire.

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

49. Wrenches that are recommended for use on gas turbine engines should be plated with which of the following elements?

- (A) Carbon
  - (B) Nickel
  - (C) Bronze
  - (D) Silver

*If choice B is selected set score to 1.*
50. When conducting a borescope inspection, you must be aware of all of the following factors EXCEPT which?

- (A) The engineer’s experience.
- (B) The limitations of your equipment.
- (C) The internal reference points.
- (D) The inspection areas and ports.

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

51. Borescope inspection of the combustor section requires which type of light source?

- (A) 150 watt
- (B) 500 watt
- (C) 1000 watt
- (D) All of the above.

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

52. All clock positions, engine references, and enclosure references apply to viewing the gas turbine engine shown in the illustration, from which of the following locations? Illustration GT-0017

- (A) Right side of the compressor to the left side.
- (B) Intake end, looking toward the exhaust end.
- (C) Left side of the power turbine to the right side.
- (D) Rear (exhaust end), looking toward the intake end.

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

53. The two main types of compressor stall are known as what?

- (A) Rapid rise and temperature inversion.
- (B) Steady state and transient.
- (C) Overspeed and overload stall.
- (D) Flame out and inlet temperature stall.

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

54. Compressor surge is caused by which of the following factors?

- (A) Maximum fuel pressure.
- (B) Interrupted air flow.
- (C) Increased demand for secondary air.
- (D) Low ambient air temperature.

*If choice B is selected set score to 1.*
55. Which of the following could cause compressor stall?
   ○ (A) The angle at which the hot gases strike the turbine rotor blades is too high.
   ○ (B) Air flow over the lower foil section becomes turbulent and destroys the pressure zone.
   ○ (C) The angle at which the air strikes the compressor rotor blades is too low.
   • (D) The angle at which the air strikes the compressor rotor blades is too high.

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

56. Where are the carbon dioxide nozzles located in the GE LM2500 gas turbine enclosure?
   ○ (A) On either side of the power turbine.
   ○ (B) Above and below the combustor section.
   • (C) On the cross beam under the compressor front frame.
   ○ (D) Above the compressor.

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

57. How is the HP turbine rotor of the GE LM2500 gas turbine cooled?
    • (A) By a continuous flow of compressor discharge air
    ○ (B) By an air to air heat exchanger
    ○ (C) By the ship’s service sea water cooling system
    ○ (D) By synthetic lube oil

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

58. What is the primary purpose of the diffuser and distributor on the GE LM2500 gas turbine?
    ○ (A) To provide even temperature distribution at the compressor
    • (B) To provide uniform air flow to the combustor
    ○ (C) To provide uniform air flow to the compressor
    ○ (D) To provide uniform air flow to the turbine

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

59. As shown in the illustration of a gas turbine fuel oil system, when the engine fuel oil valves are de-energized, the remaining fuel left in the system is recirculated back to which of the following?
Illustration GT-0021
   ○ (A) High-pressure relief valve.
   ○ (B) Day tank.
   ○ (C) Fuel purge manifold.
   • (D) Fuel pump inlet.

   *If choice D is selected set score to 1.*
60. For the GE LM2500 gas turbine shown in the illustration, the 9th stage bleed air is used for which of the following? Illustration GT-0017
   o  (A) High-pressure turbine second stage nozzle cooling.
   o  (B) Compressor balance piston cavity pressurization.
   o  (C) Power turbine cooling.
   o  (D) Sump pressurization and cooling.

   If choice C is selected set score to 1.

61. For the GE LM2500 gas turbine engine shown in the illustration, the HP turbine 1st stage nozzle vanes are cooled by which of the following? Illustration GT-0020
   o  (A) 8th stage compressor air.
   o  (B) 9th stage compressor air.
   o  (C) 13th stage compressor air.
   o  (D) 16th stage compressor air.

   If choice D is selected set score to 1.

62. Large steam drums are not required in the design of a coil-type auxiliary water-tube boiler because __________.
   •  (A) steam and water are separated in the accumulator (flash chamber)
   o  (B) the heat of combustion is sufficient to remove all moisture from the steam
   o  (C) the volume of steam is small at low pressures
   o  (D) automatic burner cycling controls steam volume and quality

   If choice A is selected set score to 1.

63. The rate of heat transfer in a water-tube auxiliary boiler can be increased by __________.
   o  (A) operating the boiler at less than normal water level
   •  (B) installing fins on the firesides of water-tubes
   o  (C) increasing the amount of excess air to the burners
   o  (D) treating the boiler water with chemical oxygen scavengers

   If choice B is selected set score to 1.

64. The boiler shown in the illustration would be classed as __________. Illustration MO-0064
   o  (A) two-pass, water-tube
   •  (B) single-pass, fire-tube, scotch marine
   o  (C) forced circulation, coil-type
   o  (D) two-pass, scotch marine

   If choice B is selected set score to 1.
65. A photoelectric cell installed in an automatically fired auxiliary boiler burner management system

- (A) opens the burner circuit upon sensing a flame failure
- (B) detects a flame failure by monitoring radiant heat from glowing refractory
- (C) requires mechanical linkage to secure the burner fuel supply
- (D) must be bypassed at low firing rates

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

66. Which of the listed sequence of events occurs when an automatic auxiliary boiler is prepurged?

- (A) The damper on the inlet side of the furnace is moved to the open position for a given number of seconds and then moved to the closed position.
- (B) The damper on the inlet side of the furnace is moved to the open position for a given number of seconds and then moved to the low fire position.
- (C) The damper is moved to the closed position for a given number of seconds and then moved to the low fire position.
- (D) The damper in the uptakes is moved to the wide-open position for a given number of seconds and then moved to the low firing rate position.

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

67. A variable capacity, pressure atomizing, fuel oil burner functions to

- (A) maintain a constant fuel temperature
- (B) provide a wide range of combustion
- (C) provide a constant fuel return pressure
- (D) maintain smokeless fuel oil atomization

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

68. When preparing to light off a cold boiler equipped with a return flow fuel oil system, the recirculating valve directs the flow of oil

- (A) directly to the fuel oil heater inlet for further warm-up
- (B) back to the fuel oil settler for further filtration
- (C) back to the suction side of the service pump
- (D) directly to the deep tanks

*If choice C is selected set score to 1.*
69. Which of the following is the advantage of operating a typical closed feedwater system for a marine boiler when compared to an open feedwater system?

- (A) Increased capability of removing and controlling dissolved oxygen.
  - (B) Allows for lower feed pump operating pressures.
  - (C) Reduced requirement for condensate purity.
  - (D) Reduced steam requirement for feedwater heating.

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

70. A major difference between the two-element and the three-element feedwater regulator control systems, is that a three-element system will additionally measure and incorporate the __________.

- (A) feedwater flow as sensed variable
  - (B) fuel oil flow to the feedwater regulator
  - (C) steam flow to the feedwater regulator
  - (D) drum water level to the feedwater regulator

*If choice A is selected set score to 1.*
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GT-0021

A

Main Drive Shaft

B

Fuel Pump

High-Pressure Relief Valve

Bypass Regulator

Pressurizing Valve

Boost Element

Barrier Screen

Filter

Metering Valve

Variable Stator Servo

Variable Stator Vane Actuators

Check Valve

Purge Valve

Drain

Shutdown Valve No. 1

Shutdown Valve No. 2

Fuel Manifold

Fuel Nozzles

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