U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q533 Gas Turbine Plants

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

1. Which of the following drawbacks of a gas turbine engine provides the greatest potential for injury to personnel?
   - (A) Mechanical stresses the engine is subject to.
   - (B) Susceptibility to foreign object damage.
   - (C) High temperature of the exhaust gases.
   - (D) High pitched noise.

   If choice D is selected set score to 1.

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

   If choice C is selected set score to 1.

3. Why is a gas turbine considered to operate on the Brayton cycle?
   - (A) Combustion causes an increase in total mass flow.
   - (B) Combustion causes large increase in pressure.
   - (C) Combustion causes no increase in volume.
   - (D) Combustion occurs with no increase in pressure.

   If choice D 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 increase 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 turbine inlet temperature.
   - (D) 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.

   If choice D 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. Power is defined as which of the following?

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

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

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

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

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

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

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

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

9. Newton's Second Law of Motion states which of the following?

- (A) The acceleration of a body is inversely proportional to the applied force.
- (B) An unbalancing force on a body tends to produce an acceleration in the opposite direction of the force applied.
- (C) An unbalancing force on a body tends to produce an acceleration in the same direction of the force applied.
- (D) The acceleration of a body is directly proportional to the mass.

*If choice C is selected set score to 1.*
10. Which of the following statements concerning fluid flow is true?

- (A) If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction decreases and the pressure decreases.
- (B) If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction decreases and the pressure increases.
- (C) If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction increases and the pressure increases.
- (D) If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction increases and the pressure decreases.

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

11. Provisions for avoiding the buildup of ice on the intake air surfaces of a gas turbine plant can be found where?

- (A) In the stack intake ducting.
- (B) In the inlet duct frame at the inlet to the engine.
- (C) In the exhaust and intake ducting.
- (D) Both A & B.

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

12. The two basic types of compressors used in gas turbine engines are which of the following?

- (A) Axial and reciprocating.
- (B) Centrifugal and reciprocating.
- (C) Axial and lobe.
- (D) Centrifugal and axial.

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

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

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

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

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

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

*If choice D is selected set score to 1.*
15. In a centrifugal compressor, which component reduces the velocity and increases the static pressure of the air?

- (A) Eductor
- (B) Impeller
- (C) Volute
- **(D) Diffuser**

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

16. An axial compressor basically consists of which of the following?

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

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

17. The purpose of the metal spray rub coating on the rotor and stator casing of an axial type compressor is which of the following?

- (A) seal the circumferential dovetails
- (B) ensure protection for the gearbox adapter when removing or replacing the bearings
- (C) control air flow through the compressor
- **(D) provide close vane to rotor and blade to stator case clearances**

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

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

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

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

19. An axial compressor stator vane that is mechanically adjusted to provide optimum compressor performance over a wide operating range is referred to as which of the following?

- (A) Variable Guide Vane (VGV)
- **(B) Inlet Guide Vane (IGV)**
- (C) Static Guide Vane (SGV)
- (D) Variable Stator Vane (VSV)

*If choice D is selected set score to 1.*
20. What is a compressor midspan shroud?

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

If choice A is selected set score to 1.

21. What are the two common forms of axial compressor rotor blade roots?

- (A) Fir tree and key.
- (B) Sawtooth and knob.
- (C) Grub and bulb.
- (D) Fir tree and bulb.

If choice D is selected set score to 1.

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

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

If choice A is selected set score to 1.

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

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

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?

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

If choice D is selected set score to 1.
25. 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.
- (B) One set of rotating blades, one set of stationary vanes.
- (C) Two sets of stationary vanes, one set of rotating blades.
- (D) One set of rotating vanes, one set of stationary blades.

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

26. The turbine nozzle blades convert the combustion gases heat and pressure energy into what form of energy?

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

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

27. What method is utilized to allow turbine nozzle blades to withstand high inlet temperatures?

- (A) Water cooling
- (B) Air cooling
- (C) Laser cooling
- (D) Thermoelectric cooling

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

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

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

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

*If choice D is selected set score to 1.*
30. What are two common methods of power turbine blade retention?
   - (A) Fir-tree and bolting
   - (B) Riveting and fir-tree
   - (C) Bulb and bolting
   - (D) Bulb and dovetail

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

31. Aboard ship, single-shaft gas turbines are used mostly as prime movers for which of the following applications?
   - (A) Auxiliary power units
   - (B) Multi-screw ships
   - (C) Generators
   - (D) Single-screw ships

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

32. What type of air seal is used in the combustor and turbine midframe of a gas turbine?
   - (A) Labyrinth-Honeycomb
   - (B) Fishmouth
   - (C) Lip-type
   - (D) Pneumatic carbon ring

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

33. 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.*

34. What type of engine starter motor is commonly found on the marine gas turbine shown in the illustration? Illustration GT-0006
   - (A) AC induction motor
   - (B) DC series wound electric motor
   - (C) Hydraulic motor
   - (D) AC synchronous motor

   *If choice C is selected set score to 1.*
35. Which of the following components removes the oil from the transfer gearbox?

- (A) Air/Oil separator
- (B) Lube and scavenge pump
- (C) Duplex filter assembly
- (D) Lube oil storage and conditioning assembly

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

36. What is the power source for the ignition exciter of a gas turbine engine?

- (A) Four lead-acid batteries
- (B) Ship's 115 volt AC system
- (C) Ship's 400 Hz system
- (D) Ship's 28 volt DC system

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

37. The electrostatic vent fog precipitator removes oil mist from which of the following areas?

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

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

38. When the main reduction gear lube oil system is secured, which of the following components maintains the air within the casing at less than 35 percent relative humidity?

- (A) Dehumidifier
- (B) Reciprocator
- (C) Precipitator
- (D) Rehumidifier

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

39. The main lubrication system utilized by the gas turbine engine shown in the illustration is what type?

Illustration GT-0017

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

*If choice A is selected set score to 1.*
40. The lube oil system shown in the illustration, consists of which of the following sub-systems? Illustration GT-0024

- (A) Sump venting.
- (B) Lube oil scavenging.
- (C) Lube oil supply.
- (D) All of the above.

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

41. 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) Provides accurately metered fuel for combustion
- (C) Acts as a hydraulic medium to actuate the fuel control
- (D) Controls the angle of the variable stator vanes

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

42. What is the approximate percentage of air extracted from the compressor that is mixed with fuel for combustion in a gas turbine?

- (A) 12%
- (B) 25%
- (C) 50%
- (D) 75%

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

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

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

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

44. How do you manually lockout an SSS clutch?

- (A) Using the special wrench provided.
- (B) Calculate the engagement speed of the SSS clutch.
- (C) Remove the SSS clutch locking pawls.
- (D) Using air pressure.

*If choice A is selected set score to 1.*
45. The purpose of the main reduction gear in a marine gas turbine propulsion installation is which of the following?

- (A) Transfer high-speed gas turbine rotation to low-speed propeller rotation.
- (B) Reduce gas turbine speed to engage the clutch.
- (C) Transfer low-speed gas turbine rotation to high-speed propeller rotation.
- (D) Increase gas turbine speed to engage the clutch.

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

46. What is the purpose of the Controllable-Pitch Propeller (CPP) hydraulic oil power system?

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

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

47. The lubrication principal utilized by the Kingsbury thrust bearing is which of the following?

- (A) Wedge-shaped oil film.
- (B) Free-sliding oil film.
- (C) Square-shaped oil film.
- (D) Cylinder-shaped oil film.

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

48. Which of the following is the principle that a magnetic speed sensor/pickup operates on?

- (A) Force is the product of mass and acceleration.
- (B) Variations in the earth's magnetic field are caused by ferrous materials.
- (C) Vibration caused by shaft rotation can determine the speed of rotation.
- (D) Voltage is produced when a ferrous material moves through a magnetic field.

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

49. When auto-starting a gas turbine engine similar to the one shown in the illustration, a "False Start" indication will initiate if which of the following conditions occurs? Illustration GT-0016

- (A) The gas generator rotor fails to reach a preset RPM after the starting motor has been energized for a preset interval.
- (B) The power turbine fails to reach a preset RPM after the gas generator reaches a preset RPM.
- (C) Power turbine outlet temperature fails to reach a preset value.
- (D) The gas generator rotor fails to reach a preset RPM after the power turbine begins to rotate.

*If choice A is selected set score to 1.*
50. Compressor characteristics are normally summarized in the form of which of the following?

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

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

51. Accelerometers are generally used on gas turbine engines to sense which of the following?

- (A) PLARA rate limited feedback to the FSEE.
- (B) Rate of rotor speed changes.
- (C) Gas generator speed with respect to power turbine speed.
- (D) High frequency vibration.

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

52. Which of the following instruments is designed to help you when performing an internal inspection of the gas turbine engine?

- (A) Oscilloscope
- (B) Stroboscope
- (C) Borescope
- (D) Telescope

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

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

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

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

54. 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.*
55. Routine water washing of the gas turbine compressor shown in the illustration, is usually performed while operating under which of the following conditions? Illustration GT-0017

- (A) At 25% power.
- (B) At 75% power.
- (C) At 100% power.
- (D) With the starter motor drive.

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

56. Which of the following could cause compressor stall?

- (A) The angle at which the air strikes the compressor rotor blades is too low.
- (B) The angle at which the hot gases strike the turbine rotor blades is too high.
- (C) Air flow over the lower foil section becomes turbulent and destroys the pressure zone.
- (D) The angle at which the air strikes the compressor rotor blades is too high.

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

57. How can compressor stall be prevented?

- (A) Installing air bleed valves in the middle of the compressor.
- (B) Lowering the angle of attack on the front stages.
- (C) Utilize a two-spool compressor rotor.
- (D) All of the above.

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

58. On a propulsion marine gas turbine, if full power temperatures become excessive, what action should the operator take?

- (A) Water wash the engine.
- (B) Reduce power to stay within limits.
- (C) Borescope the engine.
- (D) No action is needed until auto shutdown occurs.

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

59. When working with gas turbine synthetic lube oil, which of the following safety measures should always be observed?

- (A) wear eye protection and rubber gloves
- (B) avoid prolonged inhaling of vapors
- (C) thoroughly wash any area of skin contact
- (D) All of the above

*If choice D is selected set score to 1.*
60. The struts of the GE LM2500 compressor front frame provide passages for all of the following mediums EXCEPT which of the following?

- (A) Fuel oil
  - (B) Lube oil
  - (C) Seal-pressurization air
  - (D) Scavenge oil

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

61. Where are the carbon dioxide nozzles located in the GE LM2500 gas turbine enclosure?

- (A) On the cross beam under the compressor front frame.
  - (B) On either side of the power turbine.
  - (C) Above and below the combustor section.
  - (D) Above the compressor.

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

62. How is the HP turbine rotor of the GE LM2500 gas turbine cooled?

- (A) By the ship's service sea water cooling system
  - (B) By an air to air heat exchanger
  - (C) By synthetic lube oil
  - (D) By a continuous flow of compressor discharge air

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

63. What is the primary function of the main fuel control on the GE LM2500 gas turbine engine?

- (A) To control fuel temperature
  - (B) To control stator vane angle and GG speed
  - (C) To control fuel pump inlet pressure
  - (D) To control stator vane angle and bleed air discharge

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

64. 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

- (A) Sump pressurization and cooling.
  - (B) Compressor balance piston cavity pressurization.
  - (C) High-pressure turbine second stage nozzle cooling.
  - (D) Power turbine cooling.

*If choice D is selected set score to 1.*
65. For the GE LM2500 gas turbine engine shown in the illustration, the 13th stage bleed air is used for which of the following? Illustration GT-0017

- (A) Power turbine cooling.
- (B) High-pressure turbine 2nd stage nozzle cooling.
- (C) Power turbine balance piston cavity pressurization.
- (D) Sump pressurization and cooling.

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

66. You are preparing for a borescope inspection of an LM2500 gas turbine engine. You are reviewing the correct geometric orientation nomenclature which includes which of the following?

- (A) All references left, right, and radial are orientated as viewed from aft looking forward on the engine.
- (B) All references left, right, and radial are orientated as viewed from forward looking aft on the engine.
- (C) All references are made from the combustor section, forward to the hp turbine and aft to the power turbine.
- (D) All references are made from the combustor section, aft to the hp turbine and forward to the power turbine.

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

67. Downcomers installed on auxiliary package boilers are protected from direct contact with hot gases by __________.

- (A) steel baffles
- (B) several rows of screen tubes
- (C) refractory and insulation
- (D) waterwall tubes

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

68. The boiler shown in the illustration would be classed as __________. Illustration MO-0064

- (A) single-pass, fire-tube, scotch marine
- (B) two-pass, scotch marine
- (C) forced circulation, coil-type
- (D) two-pass, water-tube

*If choice A is selected set score to 1.*
69. As shown in the illustration, the component labeled "F" would be identified as a ________.
Illustration MO-0231

- (A) fuel oil service pump
- (B) waste heat boiler circulating pump
- (C) main condensate pump
- (D) boiler water feed pump

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.