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 pitched noise.
   - (D) High temperature of the exhaust gases.

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

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

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

3. Why is a gas turbine considered to operate on the Brayton cycle?
   - (A) Combustion causes no increase in volume.
   - (B) Combustion causes large increase in pressure.
   - (C) Combustion causes an increase in total mass flow.
   - (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 decrease 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 increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to increase 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) Maritime fuel congress.
   - (B) Main fuel control.
   - (C) Midframe compressor.
   - (D) Manifold fuel control.

   If choice B is selected set score to 1.

6. Power is defined as which of the following?
   - (A) The rate of applying a force.
   - (B) Work performed through a distance.
   - (C) The rate of doing work.
   - (D) Force applied through a distance.

   If choice C 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) Endothermic.
   - (B) Exothermic.
   - (C) Adiabatic
   - (D) Isothermal

   If choice C 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) 342.5 degrees R.
   - (D) 590.5 degrees R.

   If choice A is selected set score to 1.

9. Newton's Second Law of Motion states which of the following?
   - (A) An unbalancing force on a body tends to produce an acceleration in the opposite direction of the force applied.
   - (B) The acceleration of a body is inversely proportional to the applied force.
   - (C) The acceleration of a body is directly proportional to the mass.
   - (D) An unbalancing force on a body tends to produce an acceleration in the same direction of the force applied.

   If choice D 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 increases and the pressure increases.
- (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 decreases.
- (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 decreases 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) Centrifugal and axial.
- (B) Centrifugal and reciprocating.
- (C) Axial and reciprocating.
- (D) Axial and lobe.

If choice A 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 discharge.
- (C) Changes only once from inlet to outlet.
- (D) Changes only at the compressor inlet.

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) A stationary impeller and a rotating diffuser.
- (C) Stationary vanes and rotating blades.
- (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) Diffuser
- (C) Impeller
- (D) Volute

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

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

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

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

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

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

*If choice A 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) A support for the tips of the stator blades.
- (C) A method of securing stator blades.
- (D) The center of a two-piece rotor blade.

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

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

- (A) Sawtooth and knob.
- (B) Grub and bulb.
- (C) Fir tree and key.
- (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) Power turbine.
- (B) Combustor.
- (C) Compressor.
- (D) High-pressure turbine.

*If choice B 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, angular, and can-angular.
- (B) can, vortex, and can-vortex.
- (C) can, derivative, and can-derivative.
- (D) can, annular, and can-annular.

*If choice D 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) Divergent process.
- (B) Convergent-Divergent process.
- (C) Convergent process.
- (D) Deflection process.

*If choice C 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) Electrical
- (B) Kinetic
- (C) Chemical
- (D) Thermal

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

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

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

*If choice A 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) Riveted or pinned.
- (C) Bolted or welded.
- (D) Locking tabs or retaining rings.

*If choice C 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) Fir-tree design.
- (C) Locking tab design.
- (D) Retaining ring design.

*If choice B is selected set score to 1.*
30. What are two common methods of power turbine blade retention?

- (A) Bulb and dovetail
  - (B) Bulb and bolting
  - (C) Fir-tree and bolting
  - (D) Riveting and fir-tree

*If choice A 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) Single-screw ships
- (D) Generators

*If choice D 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) Fishmouth
  - (B) Lip-type
  - (C) Pneumatic carbon ring
  - (D) Labyrinth-Honeycomb

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

*If choice B 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) AC synchronous motor
- (C) DC series wound electric motor
- (D) Hydraulic motor

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

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

If choice A is selected set score to 1.

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

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

If choice D is selected set score to 1.

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

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

If choice C 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) Rehumidifier
- (B) Precipitator
- (C) Dehumidifier
- (D) Reciprocator

If choice C 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
   o (A) Lube oil scavenging.
   o (B) Lube oil supply.
   o (C) Sump venting.
   • (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?
   o (A) Acts as a hydraulic medium to actuate the fuel control
   o (B) Controls the angle of the variable stator vanes
   o (C) Provides accurately metered fuel for combustion
   • (D) Acts as a cooling medium for the lube oil cooler

   *If choice D 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?
   o (A) 12%
   • (B) 25%
   o (C) 50%
   o (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
   o (A) Clutch engages automatically once the output assembly begins rotating.
   o (B) Clutch is engaged manually prior to start up.
   • (C) Clutch engages automatically when input shaft flange is rotating faster than the output assembly.
   o (D) Pneumatic pressure from the compressor engages the clutch.

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

44. How do you manually lockout an SSS clutch?
   o (A) Remove the SSS clutch locking pawls.
   • (B) Using the special wrench provided.
   o (C) Calculate the engagement speed of the SSS clutch.
   o (D) Using air pressure.

   *If choice B 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) Transfer low-speed gas turbine rotation to high-speed propeller rotation.
- (C) Reduce gas turbine speed to engage the clutch.
- (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 propeller blade actuation and control oil for propeller pitch control.
- (B) Supplies high-pressure oil for both propeller blade actuation and stern tube sealing.
- (C) Supplies low-pressure oil for both pitch control and stern tube sealing.
- (D) Supplies high-pressure oil for blade actuation and control oil for propeller pitch control.

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

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

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

*If choice D 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) Voltage is produced when a ferrous material moves through a magnetic field.
- (D) Vibration caused by shaft rotation can determine the speed of rotation.

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

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

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

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

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

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

*If choice C 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) Stroboscope
- (B) Telescope
- (C) Borescope
- (D) Oscilloscope

*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) Silver
- (C) Bronze
- (D) Nickel

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

If choice C is selected set score to 1.

57. How can compressor stall be prevented?

- (A) Lowering the angle of attack on the front stages.
- (B) Installing air bleed valves in the middle of the compressor.
- (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) Reduce power to stay within limits.
- (B) Borescope the engine.
- (C) Water wash the engine.
- (D) No action is needed until auto shutdown occurs.

If choice A 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) avoid prolonged inhaling of vapors
- (B) thoroughly wash any area of skin contact
- (C) wear eye protection and rubber gloves
- (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) Lube oil
  - (B) Fuel oil
  - (C) Seal-pressurization air
  - (D) Scavenge oil

*If choice B 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) Above the compressor.
  - (C) Above and below the combustor section.
  - (D) On either side of the power turbine.

*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 synthetic lube oil
  - (C) By a continuous flow of compressor discharge air
  - (D) By an air to air heat exchanger

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

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

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

If choice A is selected set score to 1.

66. On a GE LM2500 gas turbine powered vessel you are conducting a borescope inspection of the compressor. What is used on each compressor stage as a reference for indexing the blades?

- (A) The locking lug blades.
- (B) The IGV actuator.
- (C) Witness marks center punched on the #1 nozzle and blade.
- (D) Scribe marks located on the stator and rotor diaphragm.

If choice A is selected set score to 1.

67. The purpose of the separating nozzle in the accumulator of a water-tube, coil-type, steam generator is to separate __________.

- (A) condensate from feedwater
- (B) superheated steam from saturated steam
- (C) dry steam from the steam and water mixture
- (D) sludge accumulations from feedwater

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

If choice A is selected set score to 1.

69. As shown in the illustration, the component labeled "G" would be identified as _______. Illustration MO-0231

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

If choice A 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.*
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