U.S.C.G. Merchant Marine Exam

Chief Engineer – Limited

Q606 Gas Turbine Plants

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

1. In the operation of a marine propulsion gas turbine, kinetic and thermal energy required to drive the main propeller shaft are extracted by the _________.
   
   • (A) power turbine  
   • (B) COWL diffuser  
   • (C) multi-stage compressor  
   • (D) Variable Stator Vane actuators

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

2. In order to get a ready indication for a normal start with a GE LM2500 marine gas turbine, what permissive(s) must be met?
   
   • (A) Fuel supply pressure must be greater than 8 psig.  
   • (B) Gas generator speed must be less than 1200 RPM and all engine trips reset.  
   • (C) Bleed air valve must be closed.  
   • (D) All of the above.

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

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

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

4. What is the purpose of the GE LM2500 gas turbine enclosure heater?
   
   • (A) To ensure enclosure temperature is maintained at 145 degrees F  
   • (B) To warm up the enclosure for maintenance personnel  
   • (C) To ensure fuel viscosity is maintained while the GTE is secured  
   • (D) To increase inlet air temperature

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

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

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

6. What type of combustor is used by the GE LM2500 gas turbine engine?

- (A) can-annular
- (B) annular
- (C) cannular
- (D) can

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

7. A gas turbine that has a regenerator between the compression and combustion sections in which exhaust gas heat energy is added to the air charge is classified as what type of engine?

- (A) Open cycle engine.
- (B) Semi-closed cycle engine.
- (C) Closed cycle engine.
- (D) Semi-open cycle engine.

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

8. For the same amount of available power, how does a low-speed two-stroke diesel engine compare to a recuperated gas turbine configuration?

- (A) The two-stroke diesel engine would burn more fuel than a recuperated gas turbine; however, the particulate and nitrogen oxide (NOx) levels in the exhaust would be lower.
- (B) The two-stroke diesel engine would burn more fuel and the particulate and nitrogen oxide (NOx) levels in the exhaust would be higher than that of a recuperated gas turbine configuration.
- (C) The two-stroke diesel engine would burn less fuel and the nitrogen oxide (NOx) levels in the exhaust would be much lower than that of a recuperated gas turbine configuration.
- (D) The two-stroke diesel engine would burn less fuel than a recuperated gas turbine; however, the levels of particulate and nitrogen oxide (NOx) levels in the exhaust would be higher.

*If choice D is selected set score to 1.*
9. In a regenerative or recuperative gas turbine cycle configuration, the heat of the turbine exhaust gas is used to do what?

- (A) Heat the compressor discharge air before it enters the combustor.
  - (B) Heat the intake air to the compressor.
  - (C) Heat the combustor discharge gas before entering the turbine.
  - (D) Heat the LP compressor discharge air before entering the HP compressor inlet.

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

10. Assuming you maintain the same power output, how will a decrease in the compressor inlet air temperature effect a gas turbine engine’s efficiency and fuel consumption?

- (A) Efficiency will increase and fuel consumption will decrease.
  - (B) Efficiency will decrease and fuel consumption will increase.
  - (C) Efficiency and fuel consumption will not be effected by a change in inlet air temperature.
  - (D) Efficiency and fuel consumption will both increase.

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

11. On a gas turbine engine, a high outside air temperature can cause high turbine inlet temperature, low mass/weight of air flow through the turbine, and which of the following conditions?

- (A) A requirement for less energy to achieve adequate compression
  - (B) Cooler exhaust gas temperature
  - (C) A requirement for more energy to achieve adequate compression
  - (D) None of the above

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

12. What is the designed compressor pressure ratio of the gas turbine compressor rotor shown in the illustration? Illustration GT-0004

- (A) 10 to 1
  - (B) 12 to 1
  - (C) 16 to 1
  - (D) 20 to 1

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

13. Which of the following is true concerning the main engine lube oil system of the marine gas turbine shown in the illustration? Illustration GT-0024

- (A) Lubrication is provided for the main reduction gears through the transfer gearbox.
  - (B) The system includes a single combined lube oil supply and scavenge pump.
  - (C) The lineshaft bearing lubrication system is provided for by the LOSCA.
  - (D) All of the above.

*If choice B is selected set score to 1.*
14. A gas turbine engine's main lube oil system pump check valve serves to maintain system prime and perform what other function?

- (A) To return oil to the main reduction gear sump
- (B) To prevent reverse flow of oil through a secured pump
- (C) To increase system pressure
- (D) None of the above

If choice B is selected set score to 1.

15. Your first step in response to a gas turbine engine high lube oil sump temperature alarm would be which of the following?

- (A) Reduce engine speed.
- (B) De-couple the engine from the main reduction gear.
- (C) Check the oil filter differential pressure.
- (D) Check the oil pressure to the sump.

If choice A is selected set score to 1.

16. The fuel oil back pressure regulator on the fuel system shown in the illustration, returns fuel to which of the following? Illustration GT-0021

- (A) Booster pump suction.
- (B) Purge valve discharge.
- (C) Fuel oil day tank.
- (D) Booster pump discharge.

If choice D is selected set score to 1.

17. The main fuel control module used on a marine gas turbine engine as shown in the illustration, is responsible for managing which function(s)? Illustration GT-0021

- (A) variable stator vane feedback lever
- (B) acceleration schedule
- (C) deceleration schedule
- (D) all of the above

If choice D is selected set score to 1.

18. A gas turbine engine is experiencing a high rate of corrosion in the hot section of the engine. Which of the following fuel contamination issues could be associated with this problem?

- (A) High salt water content in the fuel.
- (B) High ash content in the fuel.
- (C) Low pour point of the fuel.
- (D) High particle content in the fuel.

If choice A is selected set score to 1.
19. What does the term "lock-out" of a synchro-self-shifting (SSS) clutch system mean? Illustration GT-0018
   o (A) Shaft will not rotate above 10 RPM.
   o (B) Reduction gear will not rotate.
   • (C) SSS clutch will not engage.
   o (D) Shaft will not rotate.

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

20. What type of main reduction gear arrangement prevents independent axial and rotational movement of the pinions?
   o (A) Independent suspension
   • (B) Locked train
   o (C) Unlocked train
   o (D) Hydraulic suspension

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

21. The main thrust bearing directly positions which part(s) of the main reduction gear?
   o (A) High-speed pinion.
   o (B) High-speed gear.
   • (C) Bull gear.
   o (D) Low-speed pinion.

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

22. In cases where both the pinion and gear teeth of the main reduction gear have been slightly indented by foreign material, what action should you take?
   o (A) Replace both the pinion and gear.
   • (B) Both the pinion and gear should be relieved of all raised metal around the indentation.
   o (C) Closely monitor the damage to see if it spreads.
   o (D) Remove the foreign material that caused the indentation and return the unit to service.

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

23. The buildup of contamination in a gas turbine will cause all of the following conditions EXCEPT which of the following?
   o (A) Increased combustion gas temperatures
   • (B) Reduced fuel consumption
   o (C) Turbine blade corrosion
   o (D) Restricted air flow

*If choice B is selected set score to 1.*
24. The effectiveness of an off-line water wash of a GE LM2500 gas turbine engine can be enhanced by doing which of the following?

- (A) Applying the power turbine brake.
- (B) Washing the power turbine while still hot.
- (C) Stroking the Variable Stator Vanes to the maximum open position.
- (D) Motoring the engine just short of idle speed.

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

25. You are preparing for a borescope inspection of a gas turbine engine. Prior to the inspection it is recommended that you do which of the following?

- (A) Water wash both the compressor and the power turbine.
- (B) Water wash the power turbine.
- (C) Water wash the compressor.
- (D) Not water wash the engine prior to the inspection.

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

26. 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.*

27. Zero reference for the GE LM2500 gas turbine engine is established by the use of which of the following engine components?

- (A) Vane shrouds.
- (B) Carboloy blade pads.
- (C) Vane blades.
- (D) Locking lug blades.

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

28. A reddish-colored oxide usually forms on which of the following metals?

- (A) Aluminum.
- (B) Steel.
- (C) Chromium.
- (D) Magnesium.

*If choice B is selected set score to 1.*
29. Which of the following conditions will NOT be the result of a build-up of deposits in a gas turbine compressor?

- (A) Restricted air flow.
- (B) Reduced fuel consumption.
- (C) Increased combustion gas temperatures.
- (D) Turbine blade corrosion.

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

30. You are conducting a borescope inspection of the compressor section of a GE LM2500 gas turbine. In stage four, you see a slight tilt to one blade and the blade platform is raised higher than the other blades. What could be a cause of this condition and what would be your course of action?

- (A) Condition could be the result of blade root failure. Engine should be taken out of service until condition can be evaluated.
- (B) FOD damage could cause this condition. Engine can be operated at full load until next scheduled maintenance.
- (C) Metal fatigue could cause this condition. Engine can be operated but gas generator speed should be reduced.
- (D) Ice damage could cause this condition. Blade tilt should be corrected using special tool provided, then engine will be safe to operate.

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

31. Compressor tip clang can be usually attributed to which of the following operating conditions?

- (A) Continuous low-power operation.
- (B) Continuous high-power operation.
- (C) Overloading.
- (D) Compressor stall.

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

32. The dimples of a combustor dome band that has a low operating time will usually have what kind of damage?

- (A) Burn away.
- (B) Bowing.
- (C) Cracks.
- (D) Burn through.

*If choice C is selected set score to 1.*
33. While underway on a ship with gas turbine engines, the most likely indication of an engine stall is which of the following?
   o (A) A loud bang is heard.
   o (B) Combustor temperature increases.
   o (C) Engine fails to accelerate.
   • (D) All of the above.

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

34. The gage glass on a coil-type auxiliary boiler is connected to the __________.
   o (A) heating coil inlet and outlet
   o (B) water softener
   • (C) accumulator
   o (D) surge chamber

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

35. Why should the main steam stop valve of an auxiliary boiler be eased off its seat and then gently closed before lighting off?
   o (A) To check for a tight bonnet seal.
   o (B) To examine the valve stem for scars or nicks.
   o (C) To check the valve packing.
   • (D) To ensure that the valve will not be seized shut when hot.

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

36. Casing drains may be required on a waste heat boiler gas passage side to __________.
   o (A) prevent an accumulation of boiler water entering gas passages as a result of a pinhole tube leak
   o (B) as a means to sample stack gases for testing
   o (C) release excess pressure
   • (D) drain off condensation

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

37. In general, diesel engine waste heat boiler construction is usually of the __________.
   • (A) water-tube type
   o (B) dry back boiler type
   o (C) critical circulation boiler type
   o (D) cyclone furnace boiler type

   *If choice A is selected set score to 1.*
38. 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.*

39. The primary function of a flame safeguard system, as used on an automatically fired auxiliary boiler, is to prevent ________.
   - (A) accidental dry firing and overpressure
   - (B) uncontrolled fires in the furnace
   - (C) explosions in the boiler furnace
   - (D) overheating of the pressure parts

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

40. 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.*

41. The solenoid valves in the fuel oil supply line to an automatically fired auxiliary boiler, are automatically closed by ________.
   - (A) a decrease in feed temperature
   - (B) high furnace air pressure
   - (C) high steam pressure
   - (D) low steam pressure

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

42. In the water level electrode assembly, shown in the illustration, the feed pump should restart when the level of the water reaches the position indicated by arrow ‘____’. Illustration MO-0047
   - (A) E
   - (B) B
   - (C) C
   - (D) D

   *If choice C is selected set score to 1.*
43. Burner ignition failure in an automatically fired auxiliary boiler would be caused by __________.

- (A) a burned out solenoid in the oil supply valve
- (B) high temperature excess air
- (C) incorrectly setting the hotwell dump valve
- (D) an incorrectly positioned burner snubber relay

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

44. A safety valve on an auxiliary boiler simmers constantly and cannot be stopped by several quick blow-offs using the hand relieving gear. The problem may be __________.

- (A) loose dirt on the seat
- (B) exposed valve springs
- (C) a clogged drain line
- (D) a damaged seat

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

45. A feed pump for an auxiliary boiler might lose suction if the __________.

- (A) boiler water level is low
- (B) feedwater is too hot
- (C) boiler steam demand is low
- (D) feedwater is too cold

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

46. On a ship with a marine gas turbine as shown in the illustration, a fire emergency stop is initiated when __________. Illustration GT-0016

- (A) the GTM fire emergency shutdown switch located on the module is activated
- (B) one of the UV flame detectors is activated
- (C) either the primary or reserve GTM CO₂ system activates
- (D) all of the above

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

47. During an operation of a main propulsion gas turbine, the engine shuts down. Which of the following is the most probable reason for the shutdown?

- (A) High vibration on the gas generator.
- (B) Low fuel supply temperature.
- (C) High lube oil temperature.
- (D) Low sump oil level.

*If choice A is selected set score to 1.*
48. The two basic types of compressors used in gas turbine engines are which of the following?

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

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

49. 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.*

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

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

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

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

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

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

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

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

*If choice D is selected set score to 1.*
53. 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 produce a velocity increase and maintain a constant pressure.
- (B) Direct air flow to rotor blades at the correct angle and are shaped to cause a velocity increase and a pressure decrease.
- (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 each rotor stage at the correct angle and deliver air to the combustor at the correct velocity and pressure.

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

54. What is a compressor midspan shroud?

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

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

55. Which of the following statements is true concerning axial compressor disk-type rotors?

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

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

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

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

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

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

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

*If choice D is selected set score to 1.*
58. The secondary passages on the gas turbine engine fuel nozzles shown in the illustration are designed to open at approximately what pressure? Illustration GT-0005

- (A) 30 psig
- (B) 130 psig
- (C) 230 psig
- (D) 330 psig

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

59. How many fuel igniters would be installed on the marine gas turbine engine shown in the illustration? Illustration GT-0017

- (A) 1
- (B) 2
- (C) 3
- (D) 4

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

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

- (A) One set of rotating vanes, one set of stationary 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 stationary vanes, one set of rotating blades.

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

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

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

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

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

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

*If choice C is selected set score to 1.*
63. 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) Nozzle assembly.
- (C) Rotor assembly.
- (D) Diffuser assembly.

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

64. HP turbine blades are generally cooled by which of the following methods?

- (A) Cooling water entering the tip and exiting the root.
- (B) Cooling water entering the root and exiting the tip.
- (C) Compressed air entering the root and exiting the tip.
- (D) Compressed air entering the tip and exiting the root.

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

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

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

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

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

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

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

67. What type of air seal is used in the sump and turbine areas of a gas turbine engine?

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

*If choice A is selected set score to 1.*
68. What type of air seal is used in the combustor and turbine midframe of a gas turbine?

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

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

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

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

70. Before combustion can occur, the combustion air must be delivered to the combustor at a high-pressure and low-velocity. High-velocity, low-pressure air is converted to high-pressure, low-velocity air at what part of a centrifugal-type compressor?

- (A) Turning vanes.
  - (B) Diffuser.
- (C) Impeller.
- (D) Inlet plenum.

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