Applied Thermodynamics

Department of Mechanical Engineering

1. Water level indicator \_\_\_\_\_  
   a) indicates the amount of steam in the boiler  
   b) indicates the amount of water in the boiler  
   c) indicates the amount of water converted to steam  
   d) indicates the amount of steam left in the boiler

Ans. (b)

1. The function of a safety valve is \_\_\_\_\_  
   a) to release the excess steam when the steam pressure exceeds the rated pressure  
   b) to extinguish fire when the temperature reaches impermissible value  
   c) to release the excess water  
   d) it cuts off the water supply when water level reaches its maximum limit

Ans. (a)

1. Which of the following statements about blow-off cock is FALSE?  
   a) It is used to discharge the mud that has settled at the bottom  
   b) It is used to empty the boiler for cleaning  
   c) Scale and sediments are also removed when the blow-off cock is opened  
   d) It is used to fill the boiler with water

Ans. (d)

1. The part of the feed check valve which moves up and down automatically under the pressure of water on its gun metal seat is called \_\_\_\_\_  
   a) Check valve  
   b) Fusible plug  
   c) Flange  
   d) Safety valve

Ans. (a)

1. Determine the velocity coefficient if the efficiency of a convergent-divergent steam nozzle is 92%. The inlet velocity of steam is negligible.  
   a) 0.959  
   b) 0.120  
   c) 0.465  
   d) 0.542

Ans. (a)

1. Which of the following statements is TRUE about Lancashire boiler?  
   a) The length of its shell is about 10 m  
   b) It has a steam capacity of 12000 kg/hr  
   c) It is a water tube boiler  
   d) Its efficiency is about 50 to 70%

Ans. (d)

1. The efficiency of Locomotive boiler is around \_\_\_\_\_  
   a) 30%  
   b) 50%  
   c) 70%  
   d) 90%

Ans. (c)

1. Which of the following is a fixed factor on which boiler efficiency depends?  
   a) Actual firing rate  
   b) Humidity of combustion air  
   c) Condition of heat absorbing surfaces  
   d) Properties of the fuel burnt

Ans. (d)

1. Availability function (∅) is given by \_\_\_\_\_\_  
   a) U-p0V-T0S  
   b) U+p0V-T0S  
   c) –U+p0V-T0S  
   d) p0V-T0S

Ans. (b)

1. The \_\_\_\_\_\_\_\_\_ has to be rejected by any cyclic heat engine is called \_\_\_\_\_\_\_\_\_  
   a) Maximum energy, unavailable energy  
   b) Maximum energy, available energy  
   c) Minimum energy, available energy  
   d) Minimum energy, unavailable energy

Ans. (d)

1. Which of the following statement is correct?  
   a) Available energy is generally conserved  
   b) Available energy is maximum theoretical work obtainable  
   c) Available energy can either be negative or positive  
   d) Available energy is minimum theoretical work obtainable

Ans. (b)

1. When system undergoes a process such that ∫dQ/T = 0 and ∆S>0, the process is \_\_\_\_\_\_  
   a) Irreversible adiabatic  
   b) Reversible adiabatic  
   c) Isothermal  
   d) Isobaric

Ans. (a)

1. Rankine cycle comprises of \_\_\_\_\_\_\_\_\_\_\_  
   a) two isentropic processes and two constant volume processes  
   b) two isentropic processes and two constant pressure processes  
   c) two isothermal processes and two constant pressure processes  
   d) none of the mentioned

Ans. (b)

1. A simple Rankine cycle operates the Boiler at 3 MPa with an outlet temperature of 350°C and the Condenser at 50 kPa. Assuming ideal operation and processes, what is the thermal efficiency of this cycle?  
   a) 7.7  
   b) 17.7  
   c) 27.7  
   d) 37.7

Ans. (c)

1. A simple Brayton cycle has a pressure ratio of 5 and a maximum temperature of 900 K. Air enters the compressor at 100 kPa, 300 K. Based upon cold-air standard analysis assumptions, the back-work ratio of this cycle is?  
   a) 0.23  
   b) 0.53  
   c) 0.48  
   d) 0.36

Ans. (b)

1. For the same maximum pressure and heat input, the most efficient cycle is?  
   a) Brayton cycle  
   b) Carnot cycle  
   c) Rankine cycle  
   d) Dual cycle

Ans. (a)

1. A Sterling engine uses an energy source whose temperature is 727°C and an energy sink whose temperature is 27°C. How much heat must be added to the engine to produce 1 unit of work?  
   a) 1.10  
   b) 1.19  
   c) 1.43  
   d) 2.0

Ans. (c)

1. 64 kg of steam is produced at 14 bar pressure having a dryness fraction of 0.82. The feed water temperature in the boiler is 39°C. Determine equivalent evaporation if mass of coal consumed is 8 kg.  
   a) 5.05 kg of steam/kg of fuel  
   b) 7.05 kg of steam/kg of fuel  
   c) 8.05 kg of steam/kg of fuel  
   d) 10.25 kg of steam/kg of fuel

Ans. (c)

1. A boiler generates 30 kg of steam at 11.5 bar in 1 hour with the consumption of 3 kg of coal. Feed water temperature is 40°C. Calculate equivalent evaporation if the steam is dry and saturated.  
   a) 10.78 kg of steam/kg of fuel  
   b) 11.58 kg of steam/kg of fuel  
   c) 6.32 kg of steam/kg of fuel  
   d) 5.65 kg of steam/kg of fuel

Ans. (b)

1. What is Wilson line?  
   a) It is an isothermal line, at which the condensation completes  
   b) Saturation line of water is also called Wilson line  
   c) It represents the limiting condition of undercooling at which the condensation begins  
   d) It represents an Isobaric line, at which the condensation commences

Ans. (c)

1. Steam at 12 bar and 300°C enters a convergent-divergent steam nozzle and leaves at 3 bar. If the expansion of the steam is metastable, calculate the supercooled temperature.  
   a) 165°C  
   b) 143°C  
   c) 154°C  
   d) 120°C

Ans. (b)

1. Which of the following statement about metastable expansion of steam through a steam nozzle is FALSE?  
   a) It increases the discharge through the nozzle  
   b) Steam is undercooled to a temperature less than that corresponding to its pressure  
   c) Density of steam is increased  
   d) Exit velocity of the steam is increased

Ans. (d)

1. Which of the following in an implication of bleeding process?  
   a) efficiency and power developed both are increased  
   b) efficiency is decreased and power developed is increased  
   c) efficiency and power developed both are decreased  
   d) efficiency is increased and the power developed is decreased

Ans. (d)

1. According to the number of pressure stages, steam turbines are classified into \_\_\_\_\_  
   a) single cylinder and multi-cylinder  
   b) single stage and multi-stage  
   c) mono stage and multi-stage  
   d) axial and radial

Ans. (b)

1. On the basis of method of governing, steam turbines are classified into turbines with   
   a) diffuser governing and nozzle governing  
   b) throttle governing and nozzle governing  
   c) impulse governing and reaction governing  
   d) throttle governing and diffuser governing

Ans. (b)

1. In a simple impulse turbine, it is observed that 22.4 kJ energy is lost to blade friction. The uses steam at a rate of 1 kg/s. If the velocity of steam relative to the moving blade at an entrance is 300 m/s, determine the blade velocity coefficient.  
   a) 0.325  
   b) 0.456  
   c) 0.867  
   d) 0.951

Ans. (c)

1. The maximum possible efficiency of a De-laval turbine is 88.3%. Determine the nozzle angle.  
   a) 15°  
   b) 20°  
   c) 25°  
   d) 30°

Ans. (b)

1. In an impulse turbine, the axial force on the blades is zero if \_\_\_\_\_  
   a) the whirl components of the inlet and outlet absolute velocities are equal  
   b) the flow components of the inlet and outlet absolute velocities are equal  
   c) the exit velocity of steam is axial  
   d) the flow and whirl component of inlet velocity are equal

Ans. (b)

1. In centrifugal compressor velocity of flow leaving the impeller is equals to \_\_\_\_\_\_\_ in many cases.  
   a) Speed of sound  
   b) Double the speed of sound  
   c) Triple the speed of sound  
   d) None of the mentioned

Ans. (a)

1. To prevent erosion of blades, quality should not fall below  
   a) 85%  
   b) 90%  
   c) 95%  
   d) 100%

Ans. (a)