Reg. No. : | | | | | | | | | | |

Question Paper Code: 34721

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Fourth Semester

Electronics and Instrumentation Engineering

(Common to Instrumentation and Control Engineering)

01UME421 – THERMODYNAMICS AND FLUID MECHANICS

(Use of steam tables is permitted)

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Give the Kelvin Planck's statement of Second law of Thermodynamics.
2. State zeroth law and first law of thermodynamics.
3. Define: Mean effective pressure.
4. State the effect of reheating on Rankine cycle.
5. Mention the important application of compressed air.
6. Define: Specific humidity and Relative humidity.
7. What is meant by capillarity?
8. What are the parameters depending on the magnitude of capillary?
9. State the limitations of Bernoulli's theorem.
10. Define the major energy losses in pipes.

PART - B (5 x 16 = 80 Marks)

11. (a) In a gas turbine installation, air is heated inside the heat exchanger up to 750 *ºC* from the ambient temperature of 25 *ºC*. Hot air then enters into the gas turbine with the velocity of 50 *m/s* and leaves at 600 *ºC*. Air leaving the turbine enters the nozzle at 60 *m/s* velocity and leaves the nozzle at temperature of 500*ºC*. For unit mass flow rate of air, determine the following assuming adiabatic expansion in turbine and nozzle.

(i) Heat transfer to air in heat exchanger.

(ii) Power output from the turbine.

(iii) Velocity at the exit of nozzle. (16)

Or

(b) A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW. (16)

12. (a) Drive an expression for the mean effective pressure of an Otto cycle. (16)

Or

(b) A steam turbine plant working on a single stage of regenerative feed heating receive steam at *30* bar and *300°C*, the turbine exhausts to a condenser at *0.15* bar, while the bled steam is at *3* bar. Assuming that the cycle uses actual regenerative cycle. Calculate the thermal efficiency of cycle. Compare this value with a Ranking cycle operating between same boiler and condenser pressures. (16)

13. (a) A single stage double acting air compressor takes air at 0.98 *bar* and 32 *ºC* and delivers at 6.32 *bar*. The clearance is 5 *%* of the stroke volume. Te compression and expansion follow the law $PV^{1.32} = C$. The air handled by the compressor is 17 m^3 */min*. When measured at 1 *bar* and 15 *ºC*. Determine the temperature of air delivered, stroke volume and Indicated power of compressor in *kW*, if it runs at 500 *rpm*. Neglect the area of the piston rod and Take $R = 0.287$ *kJ / kg K*. (16)

Or

(b) (i) With a sketch, explain the working of a vapour compression refrigeration system. (8)

(ii) Discuss the requirement of a summer air conditioning system. Draw a schematic of the same. (8)

14. (a) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180 mm of mercury. If $C_d = 0.98$, determine the rate of flow. (16)

Or

(b) (i) Explain the working principle of Diaphragm pressure gauge. (8)

(ii) Explain different types of U- tube manometers to measure the pressure at a point with neat sketch. (8)

15. (a) Derive an expression for head loss through pipes due to friction. (16)

Or

(b) (i) Explain in detail about Turbulent Boundary layer. (10)

(ii) Write short notes on Moody's diagram. (6)