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

Question Paper Code: 41747

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Electronics and Instrumentation Engineering

14UME421 - THERMODYNAMICS AND FLUID MECHANICS

(Common to Instrumentation and Control Engineering)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The general gas equation is

   (a) PV=RT (b) PV=mRT
   (c) PV= $(RT)^m$ (d) PV = Constant

2. The internal energy of a substance depends on

   (a) temperature (b) pressure
   (c) volume (d) entropy

3. The system that do not involve heat are called

   (a) isothermal process (b) adiabatic process
   (c) steady process (d) thermal process

4. A system consisting of more than one phase is known as

   (a) heterogenous system (b) isolated system
   (c) open system (d) closed system

5. 1 micron is equivalent to

   (a) 10^{-2} cm (b) 10^{-4} cm (c) 10^{-2}mm (d) 10^{-3}cm

6. The process that follows the equation PV^n = Constant is called

   (a) polytropic process (b) constant volume process
   (c) constant temperature process (d) Adiabatic Process

7. The fluid property due to which mercury does not wet the glass is

(a) cohesion (b) Viscosity
(c) Adhesion (d) Surface tension

8. The terminal velocity of a small settling in a viscous fluid varies the

(a) Inverse of the fluid viscosity
(b) First power of its diameter
(c) inverse square of the diameter
(d) Square of the difference in specific weights of solid and fluid

9. Most commonly used joint in the underground pipe lines is the

(a) Sleeve joint (b) Coupling
(c) Expansion joint (d) Flange

10. A fluid of kinematic viscosity $0.4cm^2/sec$ flows through a 8cm diameter pipe. The maximum velocity for laminar flow will be

(a) less than 1m/sec (b) 1m/sec
(c) 1.5m/sec (d) 2m/sec

PART - B (5 x 2 = 10 Marks)

11. Define an isolated system.

12. State first law of thermodynamics.

13. What is meant by reversible process?

14. Define Capillarity

15. What are the factors influencing the frictional loss in pipe flow?

PART - C (5 x 16 = 80 Marks)

16. (a) A fluid is confined in a cylinder by a spring loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume(P= a+bV) .The internal energy of the fluid is given by the following equation U= 34 + 3.25 PV, where U is in KJ, P in KPa and V in cubic meter. If the fluid changes from an intial state of 400KPa, $0.06m^3$, with no work other than that done on the piston, find the direction and magnitude of the work and heat transfer. (16)

Or

(b) (i) It is proposed that solar energy be used to warm a large collector plate. This energy would in turn be transferred as heat to a fluid within a heat engine, and the engine would reject energy as heat to the atmosphere. Experiments

indicate that about 1880KJ/m^2 h of energy can be collected when the plate is operating at 90˚C .Estimate the minimum collector area that would be required for a plant producing 1KW useful shaft power. The atmospheric temperature may be assumed to be 20˚C. (8)

(ii) A carnot engine absorbs 200J of heat from a reservoir at the temperature of the normal boiling point of water and rejects heat to a reservoir at the temperature of the triple point of water. Find the heat rejected ,the work done by the engine and the thermal efficiency. (8)

17. (a) An air standard dual cycle has a compressing ratio of 16 and compression begins at 1 bar 50˚C. The maximum pressure is 70 bar.The heat transferred to air at constant pressure is equal to heat at constant volume. Estimate a. The pressure and temperature at the cardinal points of the cycle. b. The cycle efficiency and c. The m.e.p of the cycle C_V= 0.718 KJ/Kg.K , C_p= 1.005KJ/Kg.K. (16)

Or

(b) In an ideal brayton cycle , air from the atmosphere at 1atm, 300K is compressed to 6atm and the maximum cycle temp is limited to 1100K by using a large air fuel ratio. If the heat suppy is 100MV, find, a. the thermal efficiency of the cycle b.work ratio c.power output d. energy flow rate of the exhaust gas leaving the turbine. (16)

18. (a) A vapour compression heat pump system uses R-12 as the working fluid. The refrigerant enters the compressor at 2.4 bar, 0˚C with a volumetric flow rate of 0.6m^3/min. Compression is adiabatic to 9 bar, 60C and the saturated liquid exits the condensor at 9 bar. Determine a. The power input to the compressor. B. The heating capacity of the system. C. The coefficient of performance. d. The isentropic compression efficiency. (16)

Or

(b) In an air-refrigeration system working on reversed Brayton cycle ,the temperature of air at entrance to compressor(Pressure ratio =4, efficiency = 0.8) is 275K and the inlet pressure is 1 bar. The pressure loss in the cooler is 0.1 bar and the cold chamber it is 0.08 bar. The temperature of air at turbine (efficiency =0.85) inlet is 310K. Estimate the pressure ratio for the turbine and the COP of the cycle. (16)

19. (a) (i) What are the gauge pressure and the absolute pressure at a point 3m below the free surface of a liquid having a density of 1.53X10^3Kg/m^3 if the atmospheric pressure is equivalent to 750mm of mercury? The specific gravity of mercury is 13.6 and density of water = 1000Kg/m^3. (8)

(ii) An oil of specific gravity 0.9 is contained in a vessel. At a point the height of oil is 40m. Find the corresponding height of water at the point. (8)

Or

(b) (i) A differential manometer is connected at the two points A and B of two pipes. The Pipe A contains a liquid specific gravity of 1.5 while pipe B contains a liquid specific gravity of 0.9. The pressures at A and B are 1Kgf/cm^2 and 180Kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. (8)

(ii) An open tank contains water upto a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity 1. At the interface of the two liquids and 2. At the bottom of the tank. (8)

20. (a) Determine the difference in the elevation between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400m.The rate of flow of water through the pipe is 300litres/s. Consider all the losses and take the value of f = 0.008. (16)

Or

(b) A pipe line AB of diameter 300mm and of length 400m carries water at the rate of 50lit/s. The flow takes place from A to B where point B is 30mts above A. Find the pressure at A if the pressure at B is 19.62N/cm2.Take f = .008. (16)