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

Question Paper Code: 41053

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

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. Define system and surrounding.
2. State second law of thermodynamics.
3. What are the assumptions made in analysis of air standard cycles?
4. Distinguish between boiler mountings and accessories.
5. List the advantages of multistage compressor over single stage compressor.
6. Define COP for a `Refrigerator` and a `Heat pump`.
7. What is the difference between ideal and real fluids?
8. What is meant by pressure head?
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) (i) What is a thermodynamic process and a cyclic process? (6)

(ii) Air enters a compressor with a velocity of 60 *m/sec*, pressure 100 *kPa*, temperature 40 *ºC* and leaves the compressor with a velocity of 90 *m/sec*, 500 *kPa* and 120 *ºC*. Consider the system is adiabatic. Find the power of motor for the mass flow rate of 40 *kg/min*. (10)

Or

(b) (i) Prove that violation of Kelvin-Planck statement will violate the Clausius statement. (8)

(ii) A Carnot engine works between 300 *ºC* and 30 *ºC*. The heat supplied to the engine is 20 *kJ*. Determine: (1) Efficiency (2) Work output (3) Heat rejection. (8)

12. (a) (i) Drive an expression for the mean effective pressure of an Otto cycle. (8)

(ii) A diesel engine has a compression ratio of 10 and head addition takes place at constant pressure at 8 % of stroke. Find the air standard efficiency of the engine. Take $\gamma = 1.4$ (8)

Or

(b) (i) What is Rankine cycle? (4)

(ii) A steam power plant is supplied with dry saturated steam at a pressure of 12 *bar* and exhaust into a condenser at 0.1 *bar*. Calculate the Rankine efficiency. (12)

13. (a) (i) Drive an expression for the shaft work of a reciprocating compressor assuming zero clearance volume. (12)

(ii) When is multi –stage compression used for air? What are its advantages? (4)

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) (i) 1 m^3 of an oil weighs 9 *kN*. Calculate its density, specific weight and relative density. (8)

(ii) A gauge records a pressure of 25 kN/m^2. Calculate the corresponding absolute pressure in (i) kN/m^2 and (ii) in *m* of water. The local atmospheric pressure is 760 *mm* of mercury. (8)

Or

(b) (i) What are mechanical gauges? Explain with a neat sketch the working of any one type of mechanical gauge. (8)

(ii) U-tube manometer containing mercury was used to find the negative pressure in the pipe, containing water. The right limb was open to the atmosphere. Find the vacuum pressure in the pipe, if the difference of mercury level in the two limbs was 100 *mm* and height of water in the left limb from the centre of the pipe was found to be 40 *mm* below. (8)

15. (a) (i) State and prove the equation of continuity of flow. (6)

(ii) Water is flowing through a pipe having diameters 600 *mm* and 400 *mm* at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 kN/m^2 and the pressure at the upper end is 100 kN/m^2. Determine the difference in datum head if the rate of flow through the pipe is 60 *liters/s*. (10)

Or

(b) (i) Mention the minor losses that occur in flow through pipes. (6)

(ii) In a pipe of diameter 350 *mm* and length 75 *m* water is flowing at velocity of 2.8 *m/s*. Find the head lost due to friction using Darcy-Weisbach formula. (10)

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