KUMARAGURU college of technology
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Register Number: …….

B.E DEGREE EXAMINATIONS: APRIL/ MAY 2016

(Regulation 2013)

Sixth Semester

AERONAUTICAL ENGINEERING

U13AEE604**:** Introduction to Cryogenic Engineering

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Liquid Nitrogen Resembles water in appearance at the density of
   a) 801 kg/m^3 b) 805 kg/m^3
   c) 807kg/m^3 d) 809 kg/m^3
2. The isotopes of hydrogen are _____
3. The linear coefficient of thermal expansion (λt)is the fractional change in length per unit change in temperature while _____kept constant.
   a) Pressure b) Volume
   c) Force d) Stress
4. The intermolecular forces that unite the different polymer molecules are_____
5. In MLT θ system (T being time and θ temperature), what is the dimension of thermal conductivity?
   a) $ML^{-1}T^{-1}\theta^{-3}$ b) $MLT^{-1}\theta^{-1}$
   c) $ML\theta^{-1}T^{-3}$ d) $ML\theta^{-1}T^{-2}$
6. Metals are good conductors of heat because of _____
7. The choice of insulation for a particular application is mainly depends on
   a) Pressure b) Thermal conductivity
   c) Temperature d) Both b&c
8. Heat is conducted through a 14 cm thick wall at the rate of 35 W/m^2 when the temperature difference across the wall is 20^{o}C. The thermal conductivity of the wall is _____
9. Which one of the following factors causes major losses in rocket engines
   a) Incomplete chemical reaction b) Losses due to nozzle
   c) Losses due to pumps d) All the above
10. The highest flame temperature in a rocket engine achieved during _____

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Define cryogenics.
12. Draw the T- s diagram for cryogens.
13. What is meant by triple point and critical point in cryogens?
14. Differentiate between thermal diffusivity and thermal conductivity.
15. List out the factors considering during selection of insulation material.
16. What is meant by critical radius of insulation?
17. Define the term specific impulse.
18. What is meant by boil-off rate?
19. What is meant by flammability?
20. List out the physiological hazards in cryogenics fluids.

PART C (5 x 14 = 70 Marks)
(Answer not more than 400 words)

Q.No. 21 is Compulsory

21. Draw the T- s diagram of liquid hydrogen and also briefly discuss about its properties and application.

22. (a) Derive an expression for three dimensional heat conduction equations in Cartesian coordinates.

(OR)

(b) Briefly discuss about the response of mechanical properties of solid materials at cryogenic temperatures.

23. (a) (i) With neat sketch, explain any two methods of liquid level measurement techniques. (10)

(ii) List out the special requirements for cryogenic instruments. (04)

(OR)

(b) Write a short note on the following types of insulation methods.
i) Expanded Foams ii)Vacuum Technology iii) Evacuated Powder

24. (a) Briefly discuss about the selection of cryogenic propellants and its challenges.

(OR)

(b) With neat sketch, explain the working principle of Cryogenic rocket engine and also mention its advantages and disadvantages.

25. a) Discuss about general safety principles involved while handling cryogenic fluids.

(OR)

b) Discuss about safety consideration for liquid oxygen.

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