B.Sc.23121 - Physics Paper - I (Thermodynamics And Acoustics)

P. Pages : 3

Time : Three Hours

428 7

Max. Marks : 50

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Notes : 1. All questions are compulsory.
2. Draw neat labelled diagrams wherever necessary.

1. Either :

a) i) What is a heat engine? Define the efficiency of a heat engine? **2**

ii) Describe carnot's cycle and obtain an expression for the efficiency of an ideal heat engine working between two temperatures T_1 and T_2. **5**

iii) A 100 kW engine is operating between 217ºC and 17ºC. Calculate **3**
   a) the amount of heat absorbed.

   b) the amount of heat rejected.

   c) the efficiency of the engine.

OR

b) i) Define Entropy. Discuss its physical meaning. **2**

ii) Show that the entropy of the universe remains constant in a reversible process while it increases in a irreversible process. **5**

iii) Calculate the change in entropy when 10 grams of ice at 0ºC is converted into stream at 100ºC. **3**
   (Given : Latent heat of ice = 80 cal/gram)
   Latent heat of steam = 540 cal/gram

2. Either :

a) i) State and prove plank's radiation law for black body radiation. **5**

ii) Obtain the Wien's displacement law from Planck's law. **2**

iii) Calculate the surface temperature of the sun and moon, given : $\lambda_m = 4753 A°$ and 14×10^{-4} cm respectively, λ_m being wavelength of maximum intensity of emission (Given Wien's constant = 0.2898). **3**

OR

b) i) Explain the term Reverberation. **2**

ii) Obtain the Sabine's formula for reverberation time and explain its significance. **5**

iii) A broadcasting studio measuring 25x12x7 metres has a reverberation time of 0.90 sec when empty. What will be the reverberation time when an audience of 250 persons is present? **3**
(Given : absorption coefficient of a person = 0.4)
average absorbing area of each person = 0.6 m^2

3. Either :

a) Show that the slope of an adiabatic is γ times the slope of the isothermal where γ is the ratio of the two specific heat capacities. **2½**

b) What do you mean by thermodynamical scale of temperature? **2½**

c) State and explain Rayleigh-Jean's law and its failures. **2½**

d) Explain the mechanism of hearing. **2½**

OR

e) A certain mass of an ideal gas at 27°C and at pressure 8 atm. is expanded suddenly to four times its volume. Find **2½**
a) Final pressure.
b) Final temperature.
Given γ = 1.5.

f) Derive Clausius – Clapeyron's equation. **2½**

g) What is black body radiation? Explain its temperature dependence. **2½**

h) Discuss the requirements of a good auditorium. **2½**

4. Either :

a) Explain the concepts of reversible and irreversible processes. **2½**

b) Explain the significance of the term 'Heat Death' of the universe. **2½**

c) A body at 1500 K emits maximum energy of wavelength 20,000 A°. If the sun emits maximum energy of wavelength 6666 A°, what would be the temperature of the sun. **2½**

d) What is a microphone? **2½**
Explain any one type of microphone.

OR

e) Give applications of the first law of thermodynamics to (a) isobaric (b) adiabatic. **2½**

f) Calculate the change in boiling point of water when the pressure of steam on its surface is increased by 1 atmosphere. **2½**
Given, boiling point of water = 373°K
specific volume of steam = 1.671 m^{3}kg^{-1}
and Latent heat of steam = 2.268 x 10^6 Jkg^{-1}
1 atm = 1.013 x 10^5 N/m^2.

g)	State the Plank's quantum postulates about black body radiations.	**2½**
h)	What are the factors affecting the acoustics of a Hall? Explain them.	**2½**

5. Solve **any ten** of the followings.

a)	Define intensive and extensive variables.	**1**
b)	State carnot's theorem.	**1**
c)	State the first law of thermodynamics.	**1**
d)	Show that change in entropy in adiabatic process is zero.	**1**
e)	State any one Maxwell's thermodynamic relations.	**1**
f)	What is T-S diagram?	**1**
g)	What is emissive power of black body?	**1**
h)	Define the term, absorptive power.	**1**
i)	What is the wavelength at which human body radiates maximum energy? Temperature of the human body is 37ºC, Wien's constant (b) = 2.898 x 10^{-3} mk.	**1**
j)	Define term Noise and Music.	**1**
k)	What are transducers?	**1**
l)	Calculate the change in intensity level when the intensity of sound increases by 10^6 times its original intensity.	**1**

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