B.Sc. DEGREE EXAMINATION APRIL 2013
BRANCH III - PHYSICS
SECOND SEMESTER

REG. No._____

COURSE   :   **MAJOR – CORE**
PAPER   :   **THERMAL PHYSICS AND STATISTICAL MECHANICS**
TIME`   :   **30 MINS.**   **MAX. MARKS : 30**

SECTION – A
TO BE ANSWERED IN THE QUESTION PAPER ITSELF
ANSWER ALL QUESTIONS: **(30 x 1 = 30)**
I   **CHOOSE THE CORRECT ANSWER:**

1. If the temperature of the sun is doubled, the rate of energy received on the earth will be increased by a factor of
a) 2   b) 4   c) 8   d) 16

2. The coefficient of performance of a refrigerator working between -10°C and 20°C is
a) 8.77   b) 6.77   c) 7.77   d) 10.77

3. Let there be four articles having colours blue, red , black and white when they are heated together and allowed to cool, which article will cool at the earliest
a) blue   b) black   c) red   d) white

4. If `P' calories of heat energy is incident on a body and absorbs `Q' its coefficient absorption is
a) P/2   b) P-Q   c) Q/P   d) Q+P

5. Total change in entropy due to taking a working substance through any perfectly reversible cycle is
a) 0   b) 1   c) ∞ d) none of the above

6. The unit of thermal conductivity is
a) $W/m/K^2$ b) Wm/K^2 c) $W/m/K$ d) WK/m

7. Which of the following is not a thermodynamic coordinate
a) R   b) T   c) V   d) P

8. A hot body will radiate heat most rapidly if its surface is
a) white & polished   b) White & rough
c) black & rough   d) black & polished

9. 100 gm of ice at 0°C is mixed with 100 gm of water at 20°C. The temperature of the mixture will be
a) -30°C   b) 0°C   c) 10° C   d) -20° C

10. Low temperature can be produced by
a) using freezing mixture of salt   b) adiabatic demagnetization
c) cooling due to desorption   d) all the above

11.   The temperature at which there will be neither cooling nor heating is called
       a) inversion temperature   b) critical temperature
       c) Boyle temperature   d) boiling temperature

12.   A metal disc has a circular hole at its centre is heated. If the metal expands on
       heating the diameter of the hole will
       a) increase   b) decrease   c) remains unchanged   d) None of the above

13.   Which of these can put off fire quickly
       a) cold water   b) ice   c) hot water at 100°C   d) All the above

14.   Photon travel with velocity of
       a) light   b) sound   c) both   d) none of the above

15.   According to Planck's quantum theory, the average energy of an oscillator is
       a) $hv/(e^{hv/kT} + 1)$ b) $hv/(e^{hv/kT} - 1)$
       c) $hv/(e^{-hv/kT} - 1)$ d) $hv/(e^{-hv/kT} + 1)$

II   STATE WHETHER TRUE OR FALSE:
16.   The S.I. unit of Stefan's constant is $W/m/K^2$.
17.   During adiabatic process no heat enters or leaves the system.
18.   The entropy tends to zero during irreversible process.
19.   The fractional change in internal energy when a gas is cooled from 927°C to 27°C
       is 0.75.
20.   According to F.D. statistics the energy at absolute zero cannot be zero.

III   FILL IN THE BLANKS:
21.   When a gas is compressed the temperature increases because…………………….
22.   In severe winter water pipes burst because………………………..
23.   In Carnot cycle, the available energy/ cycle is given by …………………
24.   If a body absorbs most of the incident radiations, it will be …………………..
25.   Water is not used as thermometric liquid because ……………………….

IV   ANSWER BRIEFLY:
26.   State Stefan's law of radiation.

27.   State the 1ˢᵗ law of thermodynamics.

28.   Explain Meyers relation.

29.   Explain the Change of entropy due to change of state.

30.   What are bosons?

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SUBJECT CODE : 11PH/MC/TS24

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TIME   :   2 ½ HOURS   MAX. MARKS : 70

SECTION – B
ANSWER ANY FIVE QUESTIONS: **(5 x 5 = 25)**

1.   A wall has two layers A & B each made up of different materials. Layer A has thickness 10cm while B has thickness of 20cm, their coefficient of conductivities are in the ratio 3:1. A constant temperature difference of 35°C exist across the wall. What is the difference of temperature across the layer A.

2.   From what minimum height a block of ice has to be dropped in order that it may melt completely on hitting the ground? (latent heat of ice=3.3 x 10^5 J/kg).

3.   Calculate the change in boiling point of water when the pressure of stem on its surface is increased from 1 atm. to 1.10 atm. (Latent heat of steam 2.26 x 10^6 J/kg)

4.   Calculate the change in entropy when 10gm of ice at 0° C is converted into water at the same temperature.

5.   At what temperature, pressure remaining constant, will the rms velocity of a gas be half its value at 0°C.

6.   Deduce the Clausis-Claperyon's latent heat equation from Maxwell's thermodynamical relation.

7.   Applying M-B statistics, show that the internal energy of an ideal monoatomic gas depends only on its temperature.

SECTION – C
ANSWER ANY THREE QUESTIONS: **(3 x 15 = 45)**

8.   State and explain   i) Planck's law of radiation
                            ii) Rayleigh-Jeans law
                            iii) Wien's displacement law

9.   State Carnot's theorem and show that it is a necessary, consequence of 2nd law of thermodynamics. Prove that the efficiency of a carnot engine using ideal gas as a working substance is $\eta = (T_1 - T_2)/T_1$.

10.   Apply F.D. statistics to an electron gas and show that
       $E_F = (h^2/8m)[3N/\pi V]^{2/3}$

11.   Describe with necessary theory the method of producing very low temperatures by adiabatic demagnetization. Give a method to measure such low temperature.

12.a. Discuss Maxwell's law of velocity distribution. Obtain expressions for root mean square velocity, average and most probable velocity.

   b. Comment on Bose-Einstein statistics.

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