E 4403 (Pages : 4) Reg. No.....

Name.....

# B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2012

## Fifth Semester

Core Course—THERMAL AND STATISTICAL PHYSICS

(Common for Model I and Model II B.Sc. Physics, B.Sc. Physics—EEM and B.Sc. Physics—Instrumentation)

Time : Three Hours Maximum Weight : 25

## Part A

*Answer* all *questions.*
*Objective Type Questions—Weight 1 for each bunch.*

BUNCH I

1. The general form of first law of thermodynamics is applicable to :
   (a) All states of matter. (b) Only for gases.
   (c) Only for solids. (d) None of these.
2. The efficiency of Diesel engine is :
   (a) Greater than one. (b) Greater than petrol engine.
   (c) Less than petrol engine. (d) All the above.
3. In which process of Carnot's cycle heat is absorbed from the source ?
   (a) Isothermal expansion. (b) Adiabatic expansion.
   (c) Adiabatic compression. (d) Isothermal compression.
4. Lee's method for the determination of conductivity is suitable at :
   (a) Low temperature. (b) High temperature.
   (c) Absolute zero. (d) All the above.

BUNCH II

5. In an adiabatic process which of the following is applicable ?
   (a) Heat neither leaves nor enters the system.
   (b) Heat leaves the system.
   (c) Heat enters the system.
   (d) All the above.
6. The term entropy is associated with which law of thermodynamics ?
   (a) Zeroth. (b) First.
   (c) Second. (d) Third

Turn over

7. A black body absorbs radiations of :

(a) White light only. (b) Particular wavelength.

(c) All wavelengths. (d) All the above.

8. Which statistics forbids two particles to occupy the same cell in phase space ?

(a) BE. (b) FD.

(c) MB. (d) All the above.

BUNCH III

9. The slope of an adiabatic is greater than that of the :

(a) Isobar. (b) Isothermal.

(c) Isochoric. (d) None of these.

10. The total change in entropy of the universe for any reversible cycle is :

(a) Positive. (b) Negative.

(c) Zero. (d) None of these.

11. Of the following which represents Wien's displacement law ?

(a) $\lambda T$ = a constant. (b) $\lambda T^2$ = a constant.

(c) $\lambda T^3$ = a constant. (d) $\lambda T^4$ = a constant.

12. Maxwell's equation $\left(\frac{\partial S}{\partial P}\right)_T$ equals.

(a) $\left(\frac{\partial V}{\partial S}\right)_P$. (b) $-\left(\frac{\partial V}{\partial T}\right)_P$.

(c) $\left(\frac{\partial T}{\partial V}\right)_S$. (d) $-\left(\frac{\partial S}{\partial P}\right)_T$.

BUNCH IV

13. No engine working between two given reservoirs can be efficient than a reversible one. This statement is due to :

(a) Carnot. (b) Kelvin.

(c) Planck. (d) Clausius

14. The change of Helmholtz function during a reversible isothermal process is :

(a) External work done. (b) Work done on the system.

(c) Work done by the system. (d) None of these.

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15. The energy of an oscillator must be integral multiples of $h\gamma$ is due to :

(a) Planck. (b) Rayleigh.

(c) De Broglie. (d) Bohr.

16. Which of the following is true ?

(a) $H = U + PV$. (b) $H = U - PV$.

(c) $H = -U - PV$. (d) $H = -U + PV$.

$(4 \times 1 = 4)$

## Part B

*Answer any* **five** *questions.*
*Short Answer Questions—Weight* **1** *each.*

17. State and explain zeroth law of thermodynamics.

18. Compare Otto cycle and Diesel cycle.

19. State and explain Carnot's theorem.

20. State the principle of entropy and disorder.

21. What is enthalpy ? Explain Gibbs function.

22. Deduce $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$.

23. What is macrostate ? How is it related to microstate ?

24. What is MB distribution law ? Explain.

$(5 \times 1 = 5)$

## Part C

*Answer any* **four** *questions.*
*Short Essay / Problems—Weight* 2 *each.*

25. A tube bursts suddenly at 27°C. If the pressure of the tyre at the time of bursting is 3 atmospheres, calculate the final temperature.

26. The efficiency of a Carnot engine is found to increase from 0.3 to 0.4 when the temperature of the sink is lowered by 50°C. Calculate the temperature of sink and source.

27. Prove the Gibbs Helmholtz equation $F = U + T\left(\frac{\partial F}{\partial T}\right)_V$.

28. Calculate the change in entropy when 5kg of ice is completely converted into water at its melting point 273 K. Latent heat of ice = $335 \times 10^3$ J $kg^{-1}$.

29. Obtain the first $TdS$ equation using Maxwell's first relation.

30. Differentiate between MB and BE statistics.

$(4 \times 2 = 8)$

## Part D

*Answer any* **two** *questions.*
*Essay—Weight 4 each.*

31. Show that the change in entropy in a Carnot cycle is zero. How is entropy and disorder related ?

32. Explain the working of an Otto engine. Obtain the expression for efficiency.

33. Describe Searle's method for thermal conductivity.

$(2 \times 4 = 8)$

*permittivity using Maxwell's first relation.*