Total No. of Questions: 6 *Total No. of Printed Pages:2*

Enrollment No.....

Faculty of Science

End Sem (Even) Examination May-2019

BC3CO08 Physics-II

Programme: B.Sc. (CS) Branch/Specialisation: Computer Science

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The device which coverts heat into mechanical work is: **1**
(a) Motor (b) Generator
(c) Energy convertor (d) Heat engine

ii. In isochoric process: **1**
(a) dQ= dW (b) dW= dU (c) dQ=dU (d) dW= -dU

iii. In reversible adiabatic process, change in entropy is: **1**
(a) Zero (b) Negative (c) Positive (d) Unpredictable

iv. The zero point energy is: **1**
(a) hν (b) Zero (c) $\frac{1}{2}$ h ν (d) infinite

v. Which is the correct relationship: **1**
(a) G= H+PV (b) G= U+PV-TS
(c) G= U+PV (d) G=U – TS

vi. Helmholtz free energy of a system is available for wok in reversible: **1**
(a) Adiabatic process (b) Isochoric process
(c) Isobaric process (d) Isothermal process

vii. In a canonical ensemble, each system has the same: **1**
(a) Temperature, volume and number of particles.
(b) Energy, volume and number of particles
(c) Energy, volume and chemical potential.
(d) Pressure, volume and number of particles.

viii. If a box has four coloured balls (say black, red, green and yellow), If one ball is suddenly picked. The probability of ball to be black will be: **1**
(a) 1/2 (b) 1/4 (c) 1/8 (d) 1/16

ix. The statistics obeyed by electrons inside a metal is: **1**
(a) Maxwell –Boltzmann (b) Fermi-Dirac
(c) Bose-Einstein (d) None of these

P.T.O.

x. The black body radiation curve is well explained by: **1**
(a) Stefan's law (b) Wien's law
(c) Rayleigh-Jean's law (d) Plank's law

Q.2 i. Give an example of each, reversible and irreversible process. **2**

ii. The efficiency of Carnot engine is 0.4. If the temperature of source is 227°C, find the temperature of sink. **3**

iii. Explain the working of Carnot's ideal engine on P-V diagram and derive an expression for its efficiency. **5**

OR iv. Derive the work done in isothermal process. **5**

Q.3 i. Draw the T-S diagram of Carnot's cycle. **2**

ii. Write both the statements of second law of thermodynamics. **3**

iii. Calculate the change in entropy of perfect gas in reversible isobaric process. Find the change in entropy when 100 g of steam at 100°C changes into water at the same temperature. Take latent heat of steam=540 kilo -cal/kg. **5**

OR iv. Explain the principle of increase of entropy. Discuss the change in entropy of universe in reversible process. **5**

Q.4 i. Derive Clausius- Clapeyron Latent Heat Equation. **3**

ii. Define and explain the physical significance of Enthalpy and also derive Maxwell's thermodynamic relation from the Enthalpy. **7**

OR iii. Derive Gibbs-Helmholtz Equations. **7**

Q.5 i. What is phase space? State the postulates of statistical mechanics. **4**

ii. Explain the principle of equal a priori probability with example of four distinguishable particles a, b, c, d distributed in two identical boxes A and B. Write the possible macro states and microstates. **6**

OR iii. Derive the Boltzmann's Entropy - probability relation $S=k \log_e W$ and explain second law of thermodynamics statistically. **6**

Q.6 Attempt any two:

i. State and prove Boltzmann's canonical distribution law. **5**

ii. Draw the spectral distribution curve of Black-body radiation and explain it. **5**

iii. Compare Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac statistics. **5**

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Marking Scheme
BC3CO08 Physics-II

Q.1	i.	The device which coverts heat into mechanical work is: (d) Heat engine		**1**
	ii.	In isochoric process: (c) dQ=dU		**1**
	iii.	In reversible adiabatic process, change in entropy is: (a) Zero		**1**
	iv.	The zero point energy is: (c) $\frac{1}{2}$ h ν		**1**
	v.	Which is the correct relationship: (b) G= U+PV-TS		**1**
	vi.	Helmholtz free energy of a system is available for wok in reversible: (d) Isothermal process		**1**
	vii.	In a canonical ensemble, each system has the same: (a) Temperature, volume and number of particles.		**1**
	viii.	If a box has four coloured balls (say black, red, green and yellow), If one ball is suddenly picked. The probability of ball to be black will be: (b) 1/4		**1**
	ix.	The statistics obeyed by electrons inside a metal is: (b) Fermi-Dirac		**1**
	x.	The black body radiation curve is well explained by: (d) Plank's law		**1**
Q.2	i.	Example of reversible Example of irreversible process.	1 mark 1 mark	**2**
	ii.	Find the temperature of sink. Formula :efficiency= 1 - $\frac{T_2}{T_1}$ Where,T_2 is temperature of sink and T_1 is temperature of source 0.4=1-T_2/500 Hence,T_2 =300K=27ºC	 1 mark 2 marks	**3**
	iii.	Explanation of working P-V diagram Derivation for its efficiency.	1 mark 1 mark 3 marks	**5**
OR	iv.	Derivation of the work done in isothermal process.		**5**
Q.3	i.	T-S diagram of Carnot's cycle.		**2**
	ii.	Kelvin Plank statement Clausius statement	1.5 marks 1.5 marks	**3**
	iii.	Derivation of change in entropy Formula : change in entropy = $\frac{Q}{T} = \frac{mL}{T}$ Where m=100g=0.1kg, T=100ºC =373K, L=540 kilo -cal/kg change in entropy = $\frac{0.1x540}{373}$ =0.145 kilo-cal/K. 1 mark	3 marks 1 mark	**5**
OR	iv.	Principle of increase of entropy Change in entropy of universe in reversible process.: Derivation	2 marks 3 marks	**5**
Q.4	i.	Derivation Clausius- Clapeyron Latent Heat Equation.		**3**
	ii.	Definition of Enthalpy Physical significance Derivation of Maxwell's relation	1 mark 1 mark 5 marks	**7**
OR	iii.	Derive Gibbs-Helmholtz Equations. Derivation of first equation Derivation of second equation	 3.5 marks 3.5 marks	**7**
Q.5	i.	Definition of Phase space Postulates of statistical mechanics.	2 marks 2 marks	**4**
	ii.	Principle Possible macro states Possible micro states	3 marks 1.5 marks 1.5 marks	**6**
OR	iii.	Derivation of relation Explanation second law statistically	4 marks 2 marks	**6**
Q.6		Attempt any two:		
	i.	Boltzmann's canonical distribution law. Statement Proof	 1 mark 4 marks	**5**
	ii.	Spectral distribution curve of Black-body radiation Conclusion	 2 marks 3 marks	**5**
	iii.	Compare Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac statistics 1 mark for each point	 (1 mark * 5)	**5**

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