Progressive Education Society's

Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16, NEP 2020 (Autonomous)

End Semester Examination: OCT / NOV 2024

***Total No. of Questions**: 4/18* ***Total No. of Pages**: 2*

SECOND YEAR (B.Sc. Blended)

PHY301: Quantum mechanics and Thermodynamics

(Semester III)

Program: B.Sc. Blended **Credits:** 2
Program Specific: B.Sc. Blended (Chemistry) **Time:** 2 Hours
Course Type: DSC **Max. Marks:** 30
Paper: II **SET: A**

Instructions to the candidate:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Draw a neat, labeled diagram wherever necessary.*

SECTION: A

Q1) Answer the following **[5 X 1= 5]**

i) Write Schrödinger's time dependent equation in 1

ii) State Kirchhoff's law of radiation.

iii) State equation of continuity.

iv) State order and degree of following differential equation $d^4y/dx^4 - \sqrt{y^2 - 5} = 0$.

v) What is heat engine? Draw schematic diagram for heat engine.

SECTION: B

Q2) Answer the following (Attempt any 5/7) **[5 X 2 =10]**

i) What is momentum of gamma radiation having a wavelength $2A^0$.
(Given- h = 6.625×10^{-34} j-sec)

ii) Calculate the wavelength associated with a particle moving of momentum
a. 6.625×10^{-3} kg-m/sec (Given- h = 6.625×10^{-34} j-sec)

iii) Define eigen value and eigen function

iv) Explain the term Homogeneity of differential equation with an example.

v) What do you understand by mean free path of molecules of gas?

vi) If the compression ratio for Otto engine is 9 and ratio of principal specific heats Cp/Cv is 1.4, find the efficiency of the engine.

vii) The efficiency of Otto engine is 50%. If value of γ for the working substance is 1.5, find the compression ratio.

SECTION: C

Q3) Answer the following/Write short notes on following (Attempt any 2/4) [5 X 2 = 10]

i) Normalize the wave function of the free particle in the range -∞ to + ∞ is given by

$$\varphi\,(\mathrm{X}) = X\, e^{-\alpha x^2}$$

ii) What is transport phenomenon? Explain in brief viscosity, conductivity and self-diffusion on the basis of kinetic theory of gases.

iii) Explain Otto Cycle in brief with Indicator diagram.

iv) Carnot's engine, whose low temperature reservoir is at 10^{o}C, has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased?

SECTION: D

Q4) Answer the following (Attempt any 1/2) [5 X 1 = 5]

i) Define expectation value. Write mathematical expression for position and momentum.

ii) Explain the Planck's hypothesis.

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