# B.Sc. DEGREE EXAMINATION,NOVEMBER 2019
## II Year III Semester
## Mathematical Physics and Statistical Mechanics

**Time : 3 Hours** **Max.marks :60**

**Section A** $(10 \times 1 = 10)$ Marks

Answer any **TEN** questions

1. What do you mean by eigen values of a matrix.
2. Write the characteristic equation of a matrix $\mathbf{A}=\begin{pmatrix} \mathbf{1} & \mathbf{3} \\ \mathbf{2} & \mathbf{1} \end{pmatrix}$.
3. Define gamma function.
4. Show that $\beta(\mathbf{m},\mathbf{n}) = \beta(\mathbf{n},\mathbf{m})$.
5. Write Hermite differential equation.
6. Show that $\mathbf{H_n}\ (-\mathbf{x}) = (-\mathbf{1})^{\mathbf{n}}\ \mathbf{H_n}\ (\mathbf{x})$
7. Define phase-space.
8. State the postulates of statistical mechanics.
9. What are bosons?
10. What are Fermions?
11. Find the value of $\Gamma(1/2)$.
12. Write the Bose-Einstein distribution law.

**Section B** $(5 \times 4 = 20)$ Marks

Answer any **FIVE** questions

13. Diagonalise the matix $\mathbf{A}=\begin{pmatrix} \mathbf{c}os\theta & -\mathbf{s}in\theta & \mathbf{0} \\ \mathbf{s}in\theta & \mathbf{c}os\theta & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{1} \end{pmatrix}$.
14. Using beta function show that $\int_{\mathbf{0}}^{\infty} \frac{\mathbf{x^8}\left(\mathbf{1}-\mathbf{x^6}\right)}{(\mathbf{1}+\mathbf{x})^{\mathbf{24}}}\mathbf{d}x = \mathbf{0}$.
15. Obtain the solution of Legendre differential equation.
16. What are ensembles? Explain its types.
17. State the postulates of quantum statistics.
18. Verify Cayley-Hamilton theorem for the matrix $\begin{pmatrix} \mathbf{1} & \mathbf{2} & \mathbf{3} \\ \mathbf{2} & -\mathbf{1} & \mathbf{4} \\ \mathbf{3} & \mathbf{1} & \mathbf{1} \end{pmatrix}$.
19. Distinguish between classical and quantum statistics.

## **Section C** $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \end{bmatrix}$.

21. (i) Show that $\beta(m,n) = \frac{mn}{m+n}$

    (ii)Show that $\mathbf{2^n \Gamma\left(n+\frac{1}{2}\right) = 1.3.5\ldots(2n-1)\sqrt{\pi}}$

22. Obtain the series solution of Bessel differential equation.

23. Derive Maxwell-Boltzmann velocity distribution law.

24. Derive the Fermi-Dirac distribution law.

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