

10 APR 2019

B.Sc. Sem – VI (New CBCS)

Physics Paper - 603

Paper Code - 21838

(Quantum mechanics, Mathematical Physics & Nuclear Physics)

Time: 2 hours 30 min

Total Marks: 70

- Q-1a Define simple harmonic oscillator. Derive Schrodinger equation for it in one dimension. Discuss it's eigen value and eigen function. 12
- Q-1b Explain zero point energy. 02
- OR**
- Q-1a Define abstract operator. Prove that $[a, a^\dagger] = 1$. Discuss raising operator. Prove that eigen value of raising operator is increased by one in each operation. 11
- Q-1b Explain expectation value. 03
- Q-2a Define hermitian operator. Prove that linear momentum is an observable quantity. 07
- Q-2b Define commutator of operators. Prove that $[\hat{r}_i, \hat{p}_j] = i\hbar\delta_{ij}$ 07
- OR**
- Q-2 Define angular momentum. Obtain angular momentum operator components in spherical polar coordinate system. 14
- Q-3a Explain ordinary and singular point. Discuss series solution method with an example. 08
- Q-3b State and prove theorem – I. 04
- Q-3c Explain analytical function. 02
- OR**
- Q-3a Define gamma function. Find out value of gamma 7. 06
- Q-3b Eigen value of lowering operator is reduced by one in each operation. Prove it. 04
- Q-3c Find out types of singularity for given below function. 04
- $$(1 - x^2)y'' - 2xy' - \left(\lambda - \frac{\alpha^2}{1-x^2}\right)$$
- Q-4a Mention intrinsic properties of nuclei. 06
- Q-4b Explain Liquid drop Model. 08
- OR**
- Q-4a Discuss “ Magic numbers ” in the case of Neutrons. 08
- Q-4b Discuss the STANDARD Model elementary particles. 06
- Q-5a Describe experimental arrangement to observe Nuclear Magnetic Resonance. 07
- Q-5b Discuss how would you distinguish isomers of Organic molecules from NMR spectrum. 07
- OR**
- Q-5a What is Mossbauer effect? Describe experimental arrangement to observe Mossbauer effect. 08
- Q-5b Discuss application of Mossbauer Technique in Relativity. 06