



SLR-ST – 121

Seat No.	
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Set **P**

B.Sc. – II (Semester – IV) (CBCS) Examination, 2018
PHYSICS (New)
Modern Physics (Paper – VIII)

Day and Date : Wednesday, 16-5-2018
Time : 10.30 a.m. to 1.00 p.m.

Max. Marks : 70

- Instructions :** i) **All questions are compulsory.**
ii) **Figures to the right indicate full marks.**
iii) **Draw neat diagrams wherever necessary.**
iv) **Use of log tables and scientific calculators is allowed.**

1. Select the correct alternative from the following : 14
- i) The special theory of relativity was developed by _____
a) Lorentz b) Newton c) Einstein d) Galileo
 - ii) The inertial frame of reference is _____ frame of reference.
a) unaccelerated b) a rotating
c) an accelerated d) oscillating
 - iii) Mass of moving object always _____
a) Increases b) Decreases
c) Remains the same d) Zero
 - iv) The wavelength of matter waves is independent of _____
a) mass b) velocity c) momentum d) charge
 - v) The change in wavelength of scattered radiation due to Compton effect is proportional to _____
a) $\sin \frac{\theta}{2}$ b) $\sin^2 \frac{\theta}{2}$ c) $\sin \theta$ d) $\sin^2 \theta$
 - vi) _____ is the most common type of coupling.
a) L – S b) J – J c) L – J d) S – S
 - vii) In nuclear reactor, the chain reaction is _____
a) Uncontrolled b) Absent c) Controlled d) Indefinite

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- viii) The change in the Compton wavelength is _____
a) 2.42 Å b) 0.0242 Å c) 0.242 Å d) 24.2 Å
- ix) Spin of electron is _____
a) $\frac{1}{2}$ b) 1 c) 0 d) -1
- x) In chain reaction if the effective multiplication factor $k = 1$, then the size and mass of core is _____
a) infinity b) super critical
c) sub-critical d) critical
- xi) If the particle velocity is $c/2$, then the phase velocity of the matter wave associated with the particle is _____
a) $c/2$ b) $2c$ c) $2/c$ d) c^2
- xii) L-shell corresponds to $n =$ _____
a) 4 b) 3 c) 2 d) 1
- xiii) Radiation exhibits _____ nature.
a) Only particle b) Only wave
c) Dual d) None of the above
- xiv) Energy released per fission of U^{235} is about _____
a) 50 MeV b) 200 MeV c) 500 MeV d) 100 MeV

2. Answer **any seven** of the following :

14

- i) State Einstein's postulates of special theory of relativity.
- ii) Define inertial frame of reference.
- iii) Give any two properties of matter waves.
- iv) A particle is moving with velocity 200 m/s. Calculate phase velocity and group velocity.
- v) State Pauli's exclusion principle.
- vi) State Hund's rule.
- vii) What is nuclear fission ?
- viii) Write any two neutron induced reactions.

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3. A) Answer **any two** of the following : **10**
- i) Obtain Bohr's quantum condition on the basis of matter wave.
 - ii) An incident photon of wavelength 0.005 nm recoils at an angle of 60° after being scattered by a free electron. Find the wavelength of photon after scattering.
 - iii) Describe in details a nuclear reactor with its essential parts.
- B) Derive the expression for variation for length with velocity. **4**
4. Attempt **any two** of the following : **14**
- i) Obtain the expression for group velocity in terms of phase velocity.
 - ii) Explain various quantum numbers associated with vector atom model.
 - iii) Describe experimental arrangement to verify Compton effect.
5. Attempt **any one** of the following : **14**
- i) Describe Stern-Gerlach experiment and hence discuss the importance of its results. Using space quantization condition, for $l = 2$ determine allowed preferred orientations ($\cos \theta$) of the electron orbit with respect to reference external magnetic field.
 - ii) Derive Einstein's mass energy relation. At what speed will the mass of body be double its rest mass.
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