C.U.SHAH UNIVERSITY Winter Examination-2018

Subject Name : Nuclear Physics and Electromagnetism

Subject Code : 4SC05NPE1		Branch: B.Sc. (Physics)	
Semester : 5	Date : 05/12/2018	Time : 10:30 To 01:30	Marks : 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1 Attempt the following questions:

(14)

- **a**) Give the relation between radius of a nucleus (R) and its mass number (A).
- **b**) Name the unit in which mass of nucleus is expressed.
- c) "Iron (Fe) is found in abundance on earth." Justify the statement.
- d) Define nucleon separation energy.
- e) What do you mean by Quadrupole moment?
- f) Name any three models developed to understand the concept of a nucleus.
- **g**) What are nuclear magic numbers? How are they useful in understanding the stability of a nucleus?
- h) State Gauss's law applied in electrostatics.
- i) What is Poynting vector?
- **j**) Name the force that is used to determine the pressure of electromagnetic radiations.
- **k**) Define retarded time.
- If an electric field is moving along X-axis and magnetic field along Y-axis; then along which direction will the corresponding electromagnetic wave travel?
 i) X-axis ii) Y-axis iii) Z-axis iv) Parallel to both E and B
- **m**) Define skin depth.
- **n**) Why are Lienard-Wiechert potentials preferred over simple retarded potentials to determine the radiation from a charged particle such as an electron?

Attempt any four questions from Q-2 to Q-8

Q-2		Attempt all questions	(14)
	a)	Define binding energy of a nucleus. How is it related to mass defect?	(09)
		Explain the binding energy per nucleon plot.	
	b)	Explain briefly the two coupling methods by which the total angular momentum	(03)
		(J) of a nucleus can be determined.	
	c)	Give the expression for the charge density of a nucleus.	(02)



Q-3		Attempt all questions	(14)
	a)	Derive the formula for the magnetic moment of a nucleus.	(07)
	b)	Explain the concept of parity of a nucleus; also mention the two types of parities.	(03)
	c)	Give the difference between Bose-Einstein statistics and Fermi-Dirac statistics.	(04)
Q-4		Attempt all questions	(14)
	a)	Based on Liquid drop model, give the similarities and differences between a drop	(06)
		of liquid and the nucleus.	
	b)	Explain any two terms contributing to the semi empirical mass formula.	(04)
	c)	Mention the properties of nuclear force.	(04)
Q-5		Attempt all questions	(14)
-	a)	Derive the Lorentz-Gauge condition taking the help of Biot-Savart law.	(07)
	b)	Explain the concept of polarization.	(07)
Q-6		Attempt all questions	(14)
	a)	Derive the formula for energy flux in a plane wave <n>.</n>	(12)
	b)	State Faraday's law of induction	(02)
Q-7		Attempt all questions	(14)
	a)	Prove that electromagnetic radiation has pressure and momentum.	(10)
	b)	Explain the concept of Retarded potentials and also specify the formulas for the	(04)
		same.	
Q-8		Attempt all questions	(14)
	a)	Derive the expressions for scalar (\emptyset) and vector potentials (A) in order to	(07)
		understand the concept of radiation from an oscillating dipole.	
	b)	Explain the concept of a linear antenna.	(07)

