The Assam Royal Global University, Guwahati

Royal School of Applied and Pure Sciences
B. Sc. Physics 1st semester
Semester End Examination, February 2022
Subject Name: Modern Physics
Subject code: PHY012C103

Time: 3 Hours **Maximum Marks: 70**

Note: Attempt all questions as per instruction given.
The figures in the right-hand margin indicate marks.

Section – A

Q. 1 Answer the following questions **2X 8=16**

a) What are the assumptions of special theory of relativity?

b) What is uncertainty principle?

c) Discus with figure, how quarks forms protons and neutrons.

d) What are Alpha and Beta decay?

e) What is Bragg's law of X-ray diffraction by crystal?

f) What is Meissner effect?

g) Describe briefly population inversion for a three level system.

h) What are the three main component of a Laser construction?

Section – B

Q. 2 Answer any two questions: **6 X 2=12**

a) Discuss (i) Blackbody radiation curve (ii) Frank-Hertz experiments.

b) Discuss Bohr's postulates. Show that the total energy of an electron in an atom is quantized

c) Write down the Galilean transformation equations. Show that the time gets shortened in a very fast moving frame of reference.

Q. 3 Answer any two questions: **7 X 2=14**

a) (i) Discuss the nuclear fusion reaction in our sun. ii) Find out the values of X and Y for the following reaction $_{92}U^{235} + n \rightarrow _{54}Xe^{X} + _{Y}Sr^{94} + 2n$

b) (i) What is half-life of a radioactive decay? (ii) A radioactive substance has $2.7X10^{20}$ atoms initially, which reduces to 2/3rd in 20 sec, how many fraction of atoms of the sample will disintegrate in 60 sec.

c) Write short notes on (i) Standard model of particle physics, (ii) Nuclear fission.

Q. 4 Answer any two questions: **7 X 2=14**

a) What are Miller indices and how to determine them? Draw and indicate (111), (101) and (100) Miller planes.

b) How a PN junction and junction potential are formed? Explain with figure the band structures of intrinsic, p-type and n-type semiconductors.

c) (i) Determine the atomic packing fraction of FCC crystal (ii)What are Type-I and Type-II superconductors.

Q. 5 Answer any two questions: **7 X 2=14**

a) What are stimulated and spontaneous emissions? Deduce the relationships between Einstein's A and B coefficients.

b) Based on gain mediums how lasers can be divided? Give examples. Describe the working principle of a laser with diagram.

c) Discuss the working principle of an optical fiber. Explain why signal transmitted through optical fiber is faster?

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