EPL332
Nuclear Science and Engineering
MINOR-II

Date: 25. 03.2014
Full marks: 20 **Duration: 1 hr**

Q1. Answers should be brief and to the point. (For, B and D, indicate the correct choice only **with required explanation/mathematical steps). Any answer in this section without explanation will not be considered for evaluation. [All symbols and notations are as per convention]** **(2 X 5 = 10)**

A] In two fission reactors, D-D and D-T fuels are used. For 60 keV plasma, the reaction rate of D-T is 100 times more than D-D. If the plasma density in both the reactors is same, what is the ratio of power densities in these two reactors?

B] In a fusion breeder reactor, the tritium used in the D-T plasma must be continuously supplied. In order to achieve this, (i) a proton source is to be connected with the reactor, (ii) a fission reactor producing fast neutrons is to be connected, (iii) a fission reactor producing thermal neutrons is to be connected, (iv) none of these above choices are correct.

C] In a cyclotron, the polarity between dees(radius 0.4 m) is reversed 3×10^7 times a second. With what velocity a proton beam comes out of this accelerator?

D] Two counters having 'dead time' 400 μs are exposed to a α particle source. The observed count rates in the counters are 100 and 1000 counts/minute. The ratio of true count rates accepted by the counters are:

i. ~ 1, ii. ~10 iii. ~ 100, iv. None of the above choices.

E] In a Van de graaf generator with 10 MV potential a C beam of 10 MeV is achieved. If a C beam of 70 MeV is to be achieved (with the help of same acceleration method), what you will do?

Q2. A γ ray of energy 4 MeV produces an electron positron pair. The two particles move in opposite directions with equal speeds. The electron enters in a He gas field ionization chamber of capacitance 10 pF, and gets detected. If $W_{He} = 42.6$ eV, calculate pulse height (in terms of voltage) in the outer circuit. If, instead of electron, positron enters in the chamber, what will be the value of pulse height? [4+1]

Q3. A cyclotron has a magnetic field of 1.5 Wb/m^2. A beam of deuterons with maximum energy 13.46 MeV is extracted from this accelerator. What is the extraction radius of the beam? A beam of protons now need to be extracted 5cm away from the previous track. With appropriate calculation, show how it can be done in this cyclotron. [3 + 2]

[$m_p = 1.67 \times 10^{-27}$ kg, $e = 1.6 \times 10^{-19}$ C, 1 MeV = 1.6×10^{-13} J]