Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17PH3011** | **Duration :** | **3hrs** |
| **Sub. Name :** | **NUCLEAR AND PARTICLE PHYSICS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | From the basic principles, derive an expression for Weiszacker semi-empirical mass formula. | CO1 | 15 |
| b. | Given that av = 15.5 MeV, as = 16.8 MeV, ac = 0.72 MeV, asym = 23 MeV, ap = 34 MeV. Calculate the binding energy (total) of an uranium nucleus (). | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | Apply the schrodinger wave function to the problem of particle (an electron inside an atom) trapped inside an infinite potential well and obtain the eigen function and eigen values for a situation in which the particle wave function is not extending beyond the boundary. | CO1 | 15 |
| b. | Calculate the nuclear radius of the following nuclei with atomic number 2, 22, and 222. Write down the inference from the results. | CO1 | 5 |
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| 3. | a. | Magic numbered nuclei are more stable than other nuclei surrounding them. Prove the above statement with experimental results. | CO2 | 15 |
| b. | Discuss the failure of the liquid drop model of the nucleus briefly. | CO2 | 5 |
| (OR) | | | | |
| 4. | a. | Arrive at an expression for the ground state energy of a deuteron from the basic assumptions. | CO2 | 15 |
| b. | Given that the wave function of the neutron beam in neutron proton scattering is given by . Find the value of K if the energy of the incoming neutron beam is around 10 MeV and the depth of the potential well of the scattering center is 36 MeV. Assume the reduced mass of the system is given by m = 0.835 x 10-27 kg. | CO2 | 5 |
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| 5. | a. | Gamow’s theory of alpha decay involves classical, semi-classical and quantum mechanical arguments. Justify the above statement. | CO3 | 15 |
| b. | A person while drinking contaminated water source, takes in a mixed radioactive source. It emits alpha particle radiation, beta particle radiation and gamma radiation. Point out which radiation will be more harmful than others and state the reason. | CO3 | 5 |
| (OR) | | | | |
| 6. | a. | Define beta radiation process. Describe how beta particles interact with matter. | CO3 | 15 |
| b. | Identify and write about the radioactive decay processes given below. | CO3 | 5 |
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| 7. | a. | Dr.Homi Jehangir Bhabha is the architect of India’s indigenous nuclear power programme. Explain India’s three stage nuclear power programme with a brief description of nuclear reactors used in each stage. | CO4 | 15 |
| b. | Name the various parts of a nuclear reactor and explain about any one of them. | CO4 | 5 |
| (OR) | | | | |
| 8. | a. | Explain in detail about compound nuclear formation and direct reaction process with suitable examples. | CO4 | 15 |
| b. | Two neutron beams (1 and 2) are made as projectile particles and made to collide with a gold foil as target (). If their kinetic energies are 10 MeV and 60 MeV respectively, find out their wavelength. Identify which beam is suited for compound nucleus formation and direct reactions. | CO4 | 5 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | The world of fundamental particles is an exciting one. Elucidate your answer with a detailed classification scheme of fundamental particles. | CO5 | 15 |
| b. | Explain about Higg’s mechanism briefly. | CO5 | 5 |