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E – 3870

Reg. No. : .....

Name : .....

**Fourth Semester M.Sc. Degree Examination, July 2018**  
**Branch : PHYSICS**  
**PH 242 : Nuclear and Particle Physics**  
**(2014 Admission Onwards)**

Time : 3 Hours

Max. Marks : 75

**PART – A**

Answer **any five** questions. **Each** question carries **3** marks.

- I. a) Deuteron has no excited state, why ?
- b) Discuss the features of p-p scattering.
- c) What are the main features of shell model ?
- d) Explain the heavy ion reactions and spallation reactions with an example.
- e) Explain the Q value of nuclear reaction.
- f) Briefly discuss the photo fission.
- g) Explain, how spontaneous fission can be predicted.
- h) Describe the evidences on the existence of gluon. **(5×3=15 Marks)**

**PART – B**

Answer **all** questions. **Each** question carries **15** marks.

- II. A) Discuss the neutron proton scattering at low energies.

OR

- B) Discuss the collective nuclear model and its importance compared to the other models.

- III. A) Discuss the mechanism of nuclear fission and the calculation of critical energy based on liquid drop model.

OR

- B) Discuss the nuclear fusion in stellar interiors. Also discuss the thermo nuclear reaction in laboratory conditions.

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IV. A) Explain the different types of particle accelerators and their importance.

OR

B) Discuss quarks and gluons. Also explain the ideas of grand unified theories of fundamental forces. **(3×15=45 Marks)**

### PART – C

Answer **any three** questions. **Each** question carries 5 marks.

V. a) The total cross-section for Ni for 1.2 MeV neutrons is 3.8 barns. Calculate the fractional attenuation of a beam of such neutrons on passing through a sheet of Ni having a thickness of 0.1 mm. Density of Ni is 9 gm/cm<sup>3</sup>.

b) Calculate the total cross section for n-p scattering at neutron energy 2 MeV. Take the values  $a_t = 5.3 F$ ,  $a_s = -23.5 F$ ,  $r_{ot} = 1.7 F$  and  $r_{os} = 2.5 F$ .

$$\text{Total cross section } \sigma = \frac{3}{4} \sigma_t + \frac{1}{4} \sigma_s$$

c) What will be the fission rate for U<sup>235</sup> required to produce 2 watt and the amount of energy that is released in the complete fissioning of 1/2 kg of U<sup>235</sup>?

d) Briefly discuss the elementary particle interactions.

e) Discuss the non central forces.

f) Explain the plasma confinement in fusion reaction. **(3×5=15 Marks)**