Reg. No.										

MANIPAL
ACADEMY of HIGHER EDUCATION

DEPARTMENT OF SCIENCES, II SEMESTER M.Sc. (PHYSICS)
END SEMESTER EXAMINATIONS, APRIL 2018

Subject: Nuclear and Particle Physics [code: PHY 4208]
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date: MAX. MARKS: 50

Note: (i) Answer **ALL** questions
(ii) Draw diagrams, and write equations wherever necessary

1A. How to estimate nuclear size using mirror nuclei method. [5]

1B. Obtain momentum distribution function for beta decay and hence sketch beta ray spectra. [5]

2A. What is "Stopping Time"? Obtain an expression for stopping time for a charged particle in a traversing medium. [5]

2B. What is an ideal scintillator? Explain working principle of inorganic scintillation radiation detector? [5]

3A. Draw low lying energy levels in a single particle shell model showing spin-orbit interaction and magic numbers. [3]

3B. How does neutron absorption cross section provide evidence for shell structure? [2]

3C. For Fe (Z=26, A=57), compute total binding energy and coulomb energy using semi empirical mass formula. [5]

$$B(A,Z) = a_v A - a_s A^{2/3} - a_c \frac{Z(Z-1)}{A^{1/3}} - a_{sym} \frac{(A-2Z)^2}{A} + \delta \begin{cases} a_p A^{-3/4} & \text{even} - \text{even} \\ 0 & \text{even} - \text{odd} / \text{odd} - \text{even} \\ -a_p A^{-3/4} & \text{odd} - \text{odd} \end{cases}$$

$a_v = 15.5\text{MeV}$
$a_s = 16.8\text{MeV}$
$a_c = 0.72\text{MeV}$
$a_{sym} = 23\text{MeV}$
$a_p = 34\text{MeV}$

4A. Obtain a relation between angles and nuclear reaction cross section in lab and center of mass system. [3]

4B. What is saturation property of nuclear force? Explain. [2]

4C. Calculate the energy of protons detected at 90° when 2.1 MeV deuterons are incident on Al^{27} to produce Al^{28} with an energy difference Q= 5.5 MeV. [5]

5A. Classify and explain fundamental forces of nature. [4]

5B. Write quark structure of neutron and proton. [2]

5C. Estimate the time required for a 5 MeV particle to slowdown and stop in Silicon. Given: Range is 22×10^{-6}m. [4]