SH-V/PHS/504/DSE-2/19

B.Sc. 5th Semester (Honours) Examination, 2019-20
PHYSICS

Course ID : 52417　　　　　　**Course Code : SH/PHS/504/DSE-2**

Course Title : Astronomy and Astrophysics

Time: 2 Hours　　　　　　　　　　　　　　　**Full Marks: 40**

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* of the following:　　　　　　　　　　　2×5=10

   (a) What do you mean by astronomical distance?

   (b) Discuss about stellar Radii.

   (c) What is solar flare?

   (d) Distinguish between Absolute and Apparent luminosity of a star.

   (e) What is an Asteroid?

   (f) What are binary stars?

   (g) What do you mean by Chandrashekhar limit?

   (h) What do you mean by apparent solar time?

2. Answer *any four* of the following:　　　　　　　　　　　5×4=20

   (a) What are pulsars?

   (b) Write short note on Hubble space telescope.

   (c) How is the rotational period of a stars obtain from its spectra?

   (d) Distinguish between Reflecting and Refracting telescope.

   (e) How can be measured distance by Parallax method?

   (f) Compare between Apparent and Absolute magnitude scale.

3. Answer *any one* question:　　　　　　　　　　　　　　10×1=10

   (a)　(i) Discuss about Hubble classification of Galaxies.

   　　(ii) What do you mean by galactic Halo?

   　　(iii) Write a short note Milkyway Galaxy.　　　　　5+1+4=10

   (b)　(i) Write a short note on Hertzsprung-Russel Diagram.

   　　(ii) State and prove Hubble Law.

   　　(iii) What do you mean by Dark Matter?

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Sc. 5th Semester (Honours) Examination, 2019-20

PHYSICS

Course ID : 52417 **Course Code : SH/PHS/504/DSE-2**

Course Title : Nuclear and Particle Physics

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Section-I

1. Answer *any five* of the following: 2×5=10

   (a) Define cross section of Nuclear reaction. What is its physical significance? 1+1=2

   (b) What are the quark composition of Π^+ and Π^0. 2

   (c) Given the atomic mass of ^2_1H to be 2·0141 u, calculate the maximum wavelength of a photon which can split a deuteron. 2

   (d) Find the ground state spin parity $^{16}_8O$ and $^{31}_{15}P$. 2

   (e) Calculate the maximum kinetic energy of the electron emitted in the β-decay of free neutron. The neutron-proton mass difference is 1·30 MeV. 2

   (f) Write down the differences between compound Nuclear reaction and direct reaction. 2

   (g) Write down Bethe-Bloch formula for energy loss through ionization. What is Cherenkov radiation? 1+1=2

   (h) Write down the experimental evidences regarding the nuclear shell model concept. 2

Section-II

2. Answer *any four* of the following: 5×4=20

   (a) What is Compton scattering? Find the wavelength shift through Compton's scattering for gamma interaction with matter. Does Compton Scattering occurs for visible light? 1+3+1=5

   (b) Discuss the working principle of semiconductor detector for charge particle detection. What kind of materials are used for neutron detection? Give a process of neutron detection. 3+1+1=5

   (c) Draw the 'Binding energy per Nucleon' vs 'mass number' graph and briefly explain how this graph helps to understand the phenomena of 'nuclear fission', 'nuclear fusion' and saturation property of nuclear force. 1+4=5

   (d) What is neutrino? What lead Pauli to put forward the neutrino hypothesis? How this hypothesis solves the apparent breakdown of conservation of momentum and energy in β-decay. 1+2+2=5

   (e) Explain the working principle of a cyclotron. Why electrons are not accelerated to high energies using cyclotron. 3+2=5

(f) In the following pairs, determine which of the reactions are possible:

(i) $\Pi^- + p \rightarrow \Sigma^0 + \eta^0$

   $\Pi^- + p \rightarrow \Sigma^0 + k^0$ (Strong interaction)

(ii) $\Sigma^- \rightarrow \pi^- + \eta$

   $\Sigma^- \rightarrow \pi^- + p$ (Weak decay)

(iii) $\eta \rightarrow p + e^- + \gamma_e$

   $\eta \rightarrow p + e^- + \bar{\gamma}_e$ (Weak decay)

Section-III

3. Answer *any one* question: 10×1=10

(a) What is meant by the range of an α-particle? How does the range of α-particles in matter depend on energy? Explain Geiger-Nuttall law relating the range of α-particles and decay constant.

Draw the schematic diagram of energy loss $\left(-\frac{dE}{dx}\right)$ of Alpha, proton, deuteron and muons as a function of energy (E) while they are passing through a medium. Explain the fine structure of α-ray spectrum with the help of proper energy level diagram.   1+2+2+2+3=10

(b) Discuss Rutherford's alpha particle scattering theory with suitable mathematical analysis.

Discuss qualitatively how γ-ray interact with matter while passing through it.

In a scintillation detector, a γ-ray peak of 20 keV energy is observed at a pulse height of 32 volt. The full width at half maxima is 4 keV. Evaluate the percentage resolution of the detector.   5+3+2=10

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