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S – 5069

Reg. No. :

Name :

Fourth Semester M.Sc. Degree Examination, October 2023

Physics with Specialization in Space Physics

Special Paper

PHSP 543 : INTRODUCTION TO ASTROPHYSICS

(2020 Admission onwards)

Time : 3 Hours

Max. Marks : 75

$[G = 6.67 \times 10^{-11} N kg^{-2} m^2; m_H = 1.66 \times 10^{-27} kg; 1PC = 3 \times 10^{16} m;$

$M_{sun} = 2 \times 10^{30} kg; 1Au = 1.5 \times 10^{11} m]$

PART – A

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

1. Distinguish between solar time and sidereal time.
2. On what bases are stellar classifications made. What are the different stellar spectral classes?
3. Write down the steps of the p-p chain of reactions.
4. What are the different signals detected till now from astronomical sources?
5. What are Planetary nebulae?
6. Distinguish between open clusters and globular clusters of stars.
7. Distinguish between luminous mass and dynamical mass in the case of a galaxy cluster.
8. Comment on Hubble time as a value for the age of the universe.

(5 × 3 = 15 Marks)

P.T.O.



PART – B

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

9. (a) Derive the magnitude distance relation.
- (b) Briefly detail the components and their working principle of any two of the following.
- (i) an optical telescope
 - (ii) an X-ray telescope
 - (iii) radio telescope.

OR

10. (a) Explain how Wien's law and Stefan's law obeyed by black body radiation may be utilised for determining stellar surface temperatures and radii.
- (b) Explain the universal co-ordinate system and how the right ascension and declination of a celestial object may be determined.
11. (a) Delineate the different phases of the inter-stellar medium giving the chief characteristics of each.
- (b) Obtain an expression for the typical size of the Stromgren sphere around a star.

OR

12. (a) What is the energy production mechanism operating in stars? Obtain an expression for the nuclear time scale.
- (b) Draw the HR diagram schematically. What is the understanding about the Main Sequence?



13. (a) Distinguish between Population I and Population II stars.
(b) Briefly give the details of the distribution of stars and gas in the Milky Way Galaxy.

OR

14. (a) Bring out the salient features of the Hubble tuning fork diagram.
(b) State Hubble's Law. How was it established? How many idea of an expanding Universe be developed from Hubble's Law?

(3 × 15 = 45 Marks)

PART - C

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

15. A star has a Parallax of 7.3 milliar seconds. Its apparent magnitude is 1. How much is its absolute magnitude?
16. Two stars are of the same luminosity. Star 1 has a surface temperature of 4000 kelvin, while star 2 has a surface temperature of 10,000 kelvin. Find the ratio of their diameters.
17. The Luminosity of the sun is $3.8 \times 10^{26} \text{w}$. If the mass of a proton is 1.00727 atomic mass units(amu) and that of an alpha particle 4.0015 amu, how many neutrinos are emitted by the Sun per second? Assume that all energy production is via the P-P chain.
18. Estimate the number of protons in a white dwarf star with mass = 1.4 solar masses.
19. A spiral galaxy shows a flat rotation curve beyond a radius of 8 kpc with rotation speed 280 km/s in the flat portion. Estimate the mass present within 8 kpc radius.
20. Determine the speed of recession of a galaxy whose spectrum shows a redshift of 0.00175.

(3 × 5 = 15 Marks)

