

6097

26.12.2024 (M)

S. No. of Question Paper :
 Unique Paper Code :
 Name of Paper :
 Name of the Course :
 Semester :
 Duration: 3 Hours :

Examination Roll No.

 32227506
 Astronomy and Astrophysics
 B. Sc. (H) Physics – DSE
 V



Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt *four* questions in all including Question 1 which is compulsory.

Q1. Attempt any five questions:

(5 x 3)

- (a) How does the absolute magnitude of a star vary with the size of the star (assuming the temperature stays constant)?
 - (b) Calculate the energy per square centimeter per second reaching the Earth from the Sun.
 - (c) What is Hubble's Law? Discuss how it can be used to estimate age of the Universe?
 - (d) Calculate the diffraction limit of resolution of Mount Palomar telescope of 200 inch diameter for $\lambda = 457 \text{ nm}$.
 - (e) Calculate the horizon coordinates of the Pole star considering yourself as an observer on Earth.
 - (f) Explain existence of dark matter using rotation curves of the galaxies.
- Q2. (a) What happens with the magnetic lines of force in the astrophysical systems when the Magnetic Reynold number (R_m) is much greater than 1. Discuss the significance of this phenomenon in detail. (5)
- (b) State and Derive Virial theorem. Assuming that a galaxy cluster having 10^4 galaxies, each with mass equals to 100 times the solar mass and rotational velocity 100km/s. Given this information, calculate mass of the Galaxy cluster. (6,4)
- Q3. (a) Explain Horizon and Local Coordinates System with the help of proper diagram. (7)
- (b) In a given instant of time, we determine the horizontal coordinates of a star, finding $A(\text{Azimuth}) = 45 \text{ deg}$ and $z(\text{zenith distance}) = 70 \text{ deg}$. The observations were done from latitude of 34 deg. What are the hour coordinates of the star in that instant? (8)
- Q4. (a) Draw HR diagram for classification of stars (with appropriate scale values). Given that the estimated lifetime of the Sun on the main sequence is $\sim 10^{10}$ years, calculate the main sequence lifetime of a star of mass $5M_{\odot}$. (6,4)

(b) Rohini, a red giant star of spectral class K5 has radius 22 times the radius of Sun. Its surface temperature is 3800K. Calculate its luminosity (in units of solar luminosity) and its absolute magnitude. The absolute magnitude of the Sun is 5. (5)

Q5. (a) Discuss the Altitude-Azimuth type and Equatorial Mounting of a Telescope. (5)

(b) If two telescopes have same diameter, compare the resolving power of an optical telescope operating at wavelength 457nm and a radio telescope operating at wavelength 5cm. (5)

(c) Calculate the temperature at which a particle will have sufficient energy to ionise a hydrogen atom. Given: Ionization energy of the Hydrogen atom is 13.6 eV. (5)

Q6. (a) What are Standard Candles? Explain how Supernova Ia have been used to measure the astronomical distances. (5)

(b) Give at least four differences between evolving and steady state Universe. (4)

(c) Derive Friedmann equations using Newtonian theory. (6)

Q7. (a) Define radial and tangential velocity of a star. Derive an expression for the tangential and radial velocity of a star in the neighbourhood of the Sun as a function of its galactic latitude. (8)

(b) Define distance modulus. Derive expression for the same in terms of the distance of a star from the observer. (4)

(c) Suppose that the surface temperature of two stars say A and B is the same and the luminosity of A is higher than B. Which of the two stars is bigger in size. Give reason for the same. (3)

Table of Constants:

Mass of Sun	$M_{\odot} = 2 \times 10^{30} \text{ kg}$
Radius of Sun	$R_{\odot} = 7 \times 10^8 \text{ m}$
Temperature of Sun	$T_{\odot} = 5800 \text{ K}$
Luminosity of Sun	$L_{\odot} = 4 \times 10^{26} \text{ W}$
Solar Constant	$S = 1400 \text{ m/m}^2$
Boltzmann Constant	$K_B = 1.38 \times 10^{-23} \text{ J/K}$
Gravitational Constant	$G = 6.6 \times 10^{-11} \text{ Nm}^2 \text{ Kg}^{-2}$
Hubble Constant	$H_0 = 70 \text{ Km / s / Mpc}$

Conversions:

$$1 \text{ AU} = 1.5 \times 10^{11} \text{ m}$$

$$1 \text{ Ly} = 9.46 \times 10^{15} \text{ m}$$

$$1 \text{ pc} = 3 \times 10^{16} \text{ m}$$

(c) Fill in the blank (any five): 5X1=5

- (i) Correlation coefficient is a number betweenand.....
- (ii) Numbers of flower on a tree is a variable.
- (iii) During Biostatistics sampling, A group of individuals taken for study is called as ...
- (iv) The data that categories sample as male or Female are known as
- (v) Unitless measure of dispersion is

2. Write short notes on (any three): 3X5=15

- (i) Skewedness
- (ii) Univariate statistics
- (iii) Standard Deviation
- (iv) Ordinal Data

3. (a) What do you understand with Hypothesis testing? Explain the Single and Paired t-test with formulas. 8

(b) A botanist is studying the height (in cm) of a specific plant species grown under identical conditions in a greenhouse. The recorded heights of 10 randomly selected plants are as follows: Heights (cm): 32, 35, 37, 34, 36, 33, 35, 38, 34, 36. Calculate the Mean, Median and standard deviation and standard error for the above observations. 7

4. (a) Write the key features of Biostatistics? Explain its application in Research and Methodology. 8

(b) Explain the different methods of sampling used in Biostatistics. 7

5. a. Define the Correlation. Explain the Types of Correlation and how to Measure it. 8

b. Explain the importance of data presentation in biostatistics and discuss the advantages and limitations of using tables, graphs, and charts to represent data. 7

6. A researcher wants to determine if there is an association between gender (Male, Female) and preference for a type of diet (Vegetarian, Non-Vegetarian, Vegan). The observed data from a survey of 150 individuals are as follows:

	Vegetarian	Non-Vegetarian	Vegan	Total
Male	30	50	20	100
Female	40	5	5	50
Total	70	55	25	150

Using a significance level of 0.05, perform a Chi-Square test to determine if gender is associated with diet preference. 15

SL No of Paper : 6042
Unique Paper Code : 32167502
Name of the Paper : Biostatistics
Name of the Course : B.Sc. (Hons.) Botany
Semester : V
Duration : 3 Hours
Maximum Marks : 75

Instructions for the Candidates:

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Write your Roll No. on the top immediately on receipt of this question paper.

Attempt any five questions in all.

Question number one is compulsory

Nonscientific calculator allowed. Statistical tables provided by the college may be used if required.

1. (a) Define the following (any *five*):

5X1=5

- (i) Data
- (ii) Variable
- (iii) Comparative Statistics
- (iv) Median
- (v) SPSS
- (vi) Independent Variable

(b) True and False following (any *Five*):

5X1=5

- (i) The median of the given data 1,2,4,6,8,10,11,13 is 6
- (ii) The data collected in a biostatistics study can be applied to any population
- (iii) A 95% confidence interval for the mean is less likely to contain the population mean than the 99% confidence interval
- (iv) "Range" is the difference between the highest score of a variable and the lowest score of a variable.
- (v) Measures of central tendency determine the effect that multiple independent variables have on a dependent variable.
- (vi) Job status is an example of continuous data.
- (vii) The effect that multiple independent variables have effect on a dependent variable can be determine by Multivariate statistical analysis.