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**PG CBCS**

**M.Sc. Semester-III Examination, 2019**

**Physics**

**Paper Code: PHS-303**

**Special Paper – Cosmology and Astrophysics**

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

Use Separate scripts for Group A & Group B

## Group A

(Electronics: Cosmology)

**1. Attempt any two of the following** **(2 × 2 = 4)**

a) What are free and dummy indices of a tensor?

b) Define co-variant and contra-variant tensors.

c) Define symmetric and skew-symmetric tensors.

d) State the quotient law related to the rank of a tensor.

**2. Attempt any two of the following** **(4 × 2 = 8)**

a) Prove that if $A^i$ and $B_i$ are a contra-variant and co-variant vector respectively, then the sum $A^iB_i$ is an invariant. (4)

b) If the relation $b_j^i v_i = 0$ holds for an arbitrary co-variant vector $v_i$, show that $b_j^i = 0$ (4)

c) Discuss the Bianchi Identities. (4)

d) Discuss the inconsistency of Newtonian gravity with special theory of relativity. (4)

**3. Attempt any one of the following** **(8 × 1 = 8)**

a) For highly relativistic particles, moving at random in V, show that

$$T_{(m)}^{ik} = diag\left(\varepsilon, \frac{1}{3}\varepsilon, \frac{1}{3}\varepsilon, \frac{1}{3}\varepsilon\right)$$

Symbols have their usual meaning. (8)

b) For a fluid which consist of a collection of particles with small non-relativistic random motion, determine the expression of $T_{(m)}^{ik}$, where symbols have their usual significance. (8)

(P.T.O)

## Group B

(Electronics: Astrophysics)

**4. Attempt any <u>two</u> of the following:** **(2 × 2 = 4)**

a) What is largest and smallest planet of solar system?
b) What is spectral class of Sun?
c) What is the name of our own galaxy? What is approximate size of it?
d) What is de Vaucouleurs Law?.

**5. Attempt any <u>two</u> of the following:** **(4 × 2 = 8)**

a) Explain how one can measure distance of a nearby star using method of parallax. (4)
b) Define absolute magnitude. Vega has parallax p = 0.129 arcsec and apparent magnitude of 0.03. Find its absolute magnitude. (2+2)
c) Discuss Saha's ionisation equation. (4)
d) Discuss the galaxy classification system proposed by Hubble. (4)

**6. Attempt any <u>one</u> of the following** **(8 × 1 = 8)**

a) What is Hertzsprung-Russell (HR) diagram? Draw the location of main-sequence stars, super-giants and white dwarfs in HR diagram. Draw the location of Sun in HR diagram. (3 + 3 + 2)
b) Discuss formation and evolution of solar system. (8)

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