

Roll No.

E-984**M. Sc. (Fourth Semester) (Main/ATKT)****EXAMINATION, May-June, 2021**

PHYSICS

Paper Fourth (A)

(Astronomy and Astrophysics—II)*Time : Three Hours]**[Maximum Marks : 80***Note :** Attempt all Sections as directed.**Section—A**

1 each

(Objective/Multiple Choice Questions)**Note :** Attempt all questions.

Choose the correct answer :

1. Diameter of the Milky Way galaxy is :

- (a) 30 Mpc
- (b) 10^5 light years
- (c) 30 light years
- (d) 100000 pc

- 2. For a given type of galaxy, which one appears inconsistent ?
 - (a) E – log gas
 - (b) S – high gas
 - (c) SB – high gas
 - (d) E – high gas
- 3. Young-massive stars will hardly be located in :
 - (a) Spiral arms
 - (b) Disk
 - (c) Corona
 - (d) All of the above
- 4. Which is a characteristic of Elliptical galaxies ?
 - (a) Hot stars
 - (b) Old stars
 - (c) O-B stars
 - (d) Young stars
- 5. An irregular galaxy will not have :
 - (a) gas/dust
 - (b) young stars
 - (c) spiral arms
 - (d) All of the above
- 6. Correct sequence for the coiling of Spiral arms would be :
 - (a) SBa > SBb > SBc
 - (b) Sa < Sb < Sc
 - (c) SBa < SBb < SBc
 - (d) E1 > E2 > E3

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7. If a galaxy is classified as E5, then :
 - (a) Major axis is equal to minor axis.
 - (b) Major axis is half of the minor axis.
 - (c) Minor axis is half of the major axis.
 - (d) Major axis is 5 times the minor axis.
8. An AGN will contain :
 - (a) super massive black hole
 - (b) stellar mass black hole
 - (c) 1 solar mass black hole
 - (d) 3 solar mass black hole
9. Quasars can be found at :
 - (a) High redshift
 - (b) Low redshift
 - (c) Both high and low redshift
 - (d) Zero redshift
10. Disk galaxies show a flattened rotational curve, this suggests the presence of :
 - (a) Dark energy
 - (b) Super massive black hole at the center
 - (c) Dark matter
 - (d) Stellar black hole at the center
11. Problem with the Newtonian theory of gravitation is :
 - (a) Force is instantaneous
 - (b) Information travels with infinite speed
 - (c) Inconsistency with STR
 - (d) All of the above

12. Ratio of radiation and matter density changes with scale factor as :
 - (a) $\rho_r/\rho_d \propto 1/S^4$
 - (b) $\rho_r/\rho_d \propto S^4$
 - (c) $\rho_r/\rho_d \propto 1/S^3$
 - (d) $\rho_r/\rho_d \propto S$
13. Who for the first time contradicted Einstein's static model theoretically ?
 - (a) Edwin Hubble
 - (b) Arthur Eddington
 - (c) Franck Shu
 - (d) W. de Sitter
14. The reason for inflation is :
 - (a) Decoupling of Neutrino
 - (b) CMBR
 - (c) Quark-gluon transition
 - (d) Decoupling of forces
15. If $K > 0$, then the geometry of the universe will be :
 - (a) Closed
 - (b) Open
 - (c) Flat
 - (d) All of the above

16. The parameter K in the Friedmann model can be regarded

as :

- (a) Geometry
- (b) Curvature
- (c) Slope
- (d) All of the above

17. The universe at present is :

- (a) Radiation dominated
- (b) Matter dominated
- (c) Equally dominated by matter and radiation
- (d) Dominated by microwave

18. Temperature of the universe at present is :

- (a) 2.7 K
- (b) 273 K
- (c) 0 K
- (d) 100 K

19. Dark matter shows :

- (a) Attractive behavior
- (b) Both attractive and repulsive behavior
- (c) Repulsive behavior
- (d) Neither attractive nor repulsive behavior

20. The universe in future :

- (a) Will continue to expansion
- (b) Will halt after long time
- (c) Expansion will reverse to contraction
- (d) Will depend on the density

Section—B

2 each

(Very Short Answer Type Questions)

Note : Attempt all questions.

1. How the brightness of galaxies varies with their radius ? Draw and explain the brightness profiles of spiral and elliptical galaxies.
2. As per the above question, outer regions/edges of the galaxies are faint/cold to give sufficient optical emission. Then how could the rotation curve be derived observationally ?
3. What are the early and late types of galaxies ? Why are they called so ? Is it correct to call them this way ?
4. A photon is moving in a straight line and passes near by a massive object. What will happen next ? Explain with reason.
5. Why a big galaxy like Milky-way is treated as a dust particle in cosmology ?
6. What kind of problem arises at time $t = 0$ in cosmological models ? Explain.

7. Why did Einstein introduce lambda term in his model of Universe ? Theoretically this model was complete/successful, then why did Einstein discarded his λ model ?
8. Hydrogen H-alpha line is emitted by a quasar located at redshift of $z = 1$. Which telescope will you choose to observe this line ?

Section—C

3 each

(Short Answer Type Questions)**Note :** Attempt all questions.

1. At what speed does the Sun move around the center of Milky Way ? Find the orbital period for this motion. How would you estimate the mass of Milky Way galaxy from this analysis ?
2. Draw the observed rotation curve of a galaxy. Is it consistent with the laws of Physics ? Yes/No. Discuss your answer.
3. What are active galaxies ? How are they different from normal galaxies ? Why are they so bright ?
4. Discuss any *one* AGN briefly.
5. State Weyl's postulate and cosmological principle. Why are they important in cosmology ?
6. Discuss superluminal motion.
7. Discuss the Steady State model briefly.

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8. Discuss the evolution of matter vs. radiation densities in the Universe. Which one is presently more dominated ?

Section—D

5 each

(Long Answer Type Questions)**Note :** Attempt all questions.

1. Show the morphological sequence of galaxies in a tuning fork diagram and discuss their characteristics.

Or

Discuss the shape, size and different regions of Milky way galaxy.

2. Construct a unified model of AGNs. How would you explain different types of AGNs ? Explain with the help this model.

Or

Assuming a luminosity of $L = 10^{46}$ ergs/sec for a typical AGN, find the mass of central black hole for this AGN. What would be the accretion rate to power this AGN ?

3. Derive the Friedmann Model and discuss the evolution of Universe.

Or

List some important predictions made in General Relativity. Explain any *one* in detail.

4. List some important phenomena of early Universe. Explain any *one* in detail.

Or

What are the observational tests which can be used for in verifying the cosmological models ? Discuss any *one* test in detail.

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