Name: **Enrolment No:**	UPES University of Tomorrow

UPES

End Semester Examination, December 2023

Course: Fundamentals of Astrophysics **Semester : 5**
Program: BSc Physics (hons) **Time : 3 hrs**
Course Code: PHYS3022 **Max. Marks : 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	State and describe postulates of Olber's paradox.	**4**	**CO2**
Q 2	The parallax angle for Sirius is 0.379'' a. Find the distance to Sirius in units of parsecs. b. Determine the distance modulus for Sirius.	**4**	**CO1**
Q 3	a). State Hubble's law. b). In its rest frame, the quasar SDSS 1030+0524 produces a hydrogen emission line of wavelength λ_{rest} = 121. 6 nm. On Earth, this emission line is observed to have a wavelength of λ_{obs} = 885.2 nm. What is the redshift of the quasar?	**4**	**CO4**
Q 4	The lifetime of an electron in the first and second excited states of hydrogen is about $\Delta t = 10^{-8}$ s. What would be the natural broadening of the Hα line of hydrogen with central wavelength $\lambda = 656.3$ nm	**4**	**CO3**
Q 5	Betelgeuse has a surface temperature of 3600K. At what wavelength and frequency does the blackbody radiation of Betelgeuse peak at?	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Write a note on Bremsstrahlung radiation with the help of relevant equations.	**10**	**CO3**
Q 7	Derive the expressions for critical conditions under which a molecular cloud will collapse to initiate star formation.	**10**	**CO2**
Q 8	Describe the three important timescales in the life of a star. How would you arrange them in the order of shortest to longest? OR Elaborate on a Neutron star under the following headings 1. Formation and structure 2. Properties 3. Pulsating neutron stars	**10**	**CO4**

Q 9	With the help of a sketch, explain the structure of our galaxy, the milky way. What are the different stellar populations that the Milky Way is composed of, and which regions of the Milky way do we expect to observe the different populations?	**10**	**CO4**
SECTION-C (2Qx20M=40 Marks)			
Q 10	Illustrate in brief the important stages of evolution of a low mass star ($M<8M_{sun}$). Plot these stages roughly on an H-R diagram.	**20**	**CO1**
Q 11	a). Titan, the largest moon of Saturn, has a mean orbital radius of $1.22 x 10^9$ m. The orbital period of Titan is 15.95 days. Hyperion, another moon of Saturn, orbits at a mean radius of $1.48 x 10^9$ m. Estimate the orbital period of Hyperion in days. b). The orbital sidereal period of Io, one of the four Galilean moons of Jupiter, is 1 .77 days and the semimajor axis of its orbit is 4.22×10^8 m. Assuming that the mass of Io is insignificant compared to that of Jupiter, estimate the mass of Jupiter. OR State and derive Virial’s theorem.	**20**	**CO4**