

DEPARTMENT OF SCIENCES III SEMESTER M.Sc. (PHYSICS)

END SEMESTER REGULAR EXAMINATIONS, NOVEMBER & DECEMBER 2023 PHY6051: FUNDAMENTALS OF ASTRONOMY AND ASTROPHYSICS (OPEN ELECTIVE) (CHOICE BASED CREDIT SYSTEM - 2020)

Time: 3 Hours	Date: 05-12-2023	MAX. MARKS: 50
Note (i) Answer ALL questions	(ii) Draw diagrams, and write	equations wherever necessary
 Useful data: 1 Light year = 9.461 × 10¹² km 1 AU = 1.496 × 10⁸ km = 1.581 × 10⁻⁵ ly 1 parsec = 2.06 × 10⁵ AU = 3.26 light years Stephan-Boltzmann constant = 5.67 × 10⁻⁸ We Wien's constant = 2.9×10⁶ nmK Radius of Sun = 696000 km 	• Mass of Sun = 2 : • The average dens • Luminosity of Su • $G = 6.674 \times 10^{\circ}$ • $k = 1.381 \times 10^{\circ}$ • Mass of Hydroge • Mass of Electron • Planck's constant	× 10^{30} kg ity of Sun = 1410 kgm ⁻³ n = 3.846×10^{26} W 0 ⁻¹¹ Nm ² /kg ² 0 ⁻²³ J/K en atom = 1.67×10^{-27} kg = 9.11×10^{-31} kg = 6.626×10^{-34} Js

<u>Q. No.</u>		Marks	CO	BL
1A	Obtain an equation for electron degeneracy pressure in white dwarfs	4	1	3
1B	Describe the classification system of elliptical and spiral galaxies	3	2	2
1C	Explain why the hydrogen lines are relatively weaker in the spectra of stars having very high or very low temperature	3	1	3
2A	Describe the following: (a) Hubble's law, (b) Planck epoch, (c) Era of recombination, (d) cosmic background radiation and (e) Cosmological principle	5	2	2
2B	Describe the structure and operation of Newtonian, Cassegrain and Coude type telescopes with the help of neat diagrams	5	1	2
3A	Describe the inner structure of Sun with the help of a neat diagram	3	1	2
3B	Describe the origin of dark matter hypothesis	2	2	2
3C	Derive the equations for Jeans mass and Jeans length. Find the Jeans length and mass in a cloud with 10^5 H atoms per cubic centimetre and a temperature of 50 K	5	1	3
4A	Consider a rotating neutron star with a mass equal to 2 times solar mass and a radius 15 km, a period of 0.1 s, and a rate of change of the period $dP/dt = 3 \times 10^{-6} s/year$ Find (a) the kinetic energy, (b) the rate at which the kinetic energy is decreasing, and (c) the lifetime of the pulsar if it loses energy at this rate	3	1	3
4B	Describe the formation of type I & type II supernovae	4	1	2
4C	Describe the internal structure of a supergiant star with a neat diagram	3	1	2
5A	Differentiate between transverse, radial and space velocities of stars. Explain how the radial velocity of a star can be determined from stellar spectra.	3	1	2
5 B	If the proper motion of a star is found to be 2 arc sec/year and the star has a parallax of 0.1 arc sec, find its transverse velocity. The 656.3 <i>nm</i> spectral line of Hydrogen was found to have shifted to 656.5 <i>nm</i> in the spectrum of the star mentioned above. What is its radial velocity? Also, find its appear velocity (1 grasse = 4.95 × 10^{-6} rsd)	4	1	3
5C	Describe energy production in stars through p-p chain and triple alpha process	3	1	2