Name: **Enrolment No:**	

UPES
End Semester Examination, May 2025

Course: Stellar Evolution **Semester: VI**
Program: B. Sc **Time: 03 hrs.**
Course Code: PHYS 3024P **Max. Marks: 100**

Instructions: Answer all questions in Section A. Answer any 4 questions in Section B. Answer any 2 questions in Section C.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	COs
Q 1	Evaluate the mean number of scatterings the photons would suffer within the Sun considering the average time to escape is 10^6 years.	**4**	**CO3**
Q 2	Write down Saha's ionization equation explaining all of the terms. Mention two uses of Saha's equation.	**2+2**	**CO3**
Q 3	For $\boldsymbol{\rho = \rho_c[1-(r/R)]}$, calculate the average density of the star, where ρ, ρ_c, r, and R are density, central density, radial distance, and radius of the star respectively.	**4**	**CO2**
Q 4	Define Eddington's luminosity. Calculate the Eddington's luminosity for 50 $M_\odot$ star.	**2+2**	**CO1**
Q 5	Mention at least four uses of Lane-Emden's equation.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 1	Calculate the fractional mass within a star where radiation pressure and gas pressure are equal. Use point source model to obtain the result.	**10**	**CO4**
Q 2	Arrive at the temperature gradient equation to show that the stellar temperature profile drops as radius increases.	**10**	**CO3**
Q 3	What are the differences between Euler and Lagrangian derivatives? Write down the operator to evaluate the change of any physical quantity in a moving co-ordinate. Use the operator to obtain the steady state form of the Euler equation.	**2+2+6**	**CO3**
Q 4	Evaluate the dynamical time scales for 10 & 50 $M_\odot$ stars. The mass-radius relationship could be assumed as $(R/R_\odot) \alpha (M/M_\odot)^{4/5}$ for main sequence stars.	**5 + 5**	**CO2**

	Or Describe the evolution process of low mass stars with suitable diagrams.	**10**	
SECTION-C (2Qx20M=40 Marks)			
Q 1	Derive the energy equation of main sequence stars.	**20**	**CO2**
Q 2	Obtain the $R^{(3-n)}$ α $1/ M^{(n-1)}$ using Lane-Emden's equation, where R, M, and n are radius, mass and polytropic index of a star respectively. Or Demonstrate the isothermal stellar wind solution which causes mass loss from a star.	**20**	**CO4**