UPES
End Semester Examination, December 2023

Course: Radiative Processes in Astrophysics   Semester   : 3
Program: MSc Physics   Time   : 03 hrs.
Course Code: PHYS8088P   Max. Marks : 100

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What do you understand by radiation pressure? Deduce the relationship between radiation pressure and energy density of a field.	4	CO2
Q 2	Explain the concept of retarded potentials with the help of mathematical expressions without derivation.	4	CO1

Q 3	Briefly describe the following -
	  1. Thomson scattering
	  2. Compton scattering
		4	CO4

Q 4	Describe the two parts of Blackbody spectrum with the help of plot and equations.	4	CO2
Q 5	Write a note on Stoke's parameters for monochromatic waves.	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	Elaborate on Wave equation taking Maxwell's equation in vacuum as your starting point.	10	CO1
Q 7	Explain hyperfine transitions taking Hydrogen 21-cm line as an example.	10	CO4
Q 8	Give a detailed account of radiation taking place when the particle is accelerated in the presence of a magnetic field relativistically. Sketch the power spectrum for the process along with relevant equations. OR Enumerate various sources of synchrotron radiation in astrophysics.	10	CO3
Q 9	Describe inverse Compton scattering.	10	CO4

SECTION-C
(2Qx20M=40 Marks)

Q 10	Derive the expressions for Thomson cross-section for an electron. Given the mass and charge of electron, $m= 9.10938356 \times 10^{-31}$ kg and $e= 1.602 \times 10^{-19}$ coulombs, calculate the value of Thomson cross-section for an electron.	20	CO4

Q 11	Discuss Bremsstrahlung radiation under the following headings - 1. Nature of radiation 2. Power radiated. 3. Bremsstrahlung in ICM and HII regions. OR State the Poynting's theorem and derive the expression for Poynting vector with appropriate symbols and their meanings.	5+5+10 20	 CO3