PHE-15

ASSIGNMENT BOOKLET
Bachelor's Degree Programme
ASTRONOMY AND ASTROPHYSICS

Valid from January 1, 2020 to December 31, 2020

It is compulsory to submit the assignment response before filling up the Term-end Examination Form.

Please Note

- **You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.**
- **You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.**
- **At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.**
- **You cannot appear in the Term-End Examination of any course without registering for the course. Otherwise, your result will not be declared and the onus will be on you.**

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2020)

Dear Student,

We hope you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-read the section on assignments for Elective Courses in the Programme Guide that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation which would consist of **one tutor-marked assignment** (**TMA**) for this course.

Instructions for Formatting Your Assignment:

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your TMA answer sheet, please write the details exactly in the following format:

ENROLMENT NO.:……

NAME :……

ADDRESS :……

……

……

COURSE CODE: …….

COURSE TITLE : …….

ASSIGNMENT NO. ……..…

STUDY CENTRE: ……..….. DATE:..……...

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
4) Your answers should be precise.
5) While solving problems, clearly indicate the question number along with the part being solved. Be precise. Write units at each step of your calculations as done in the text because marks will be deducted for such mistakes. Take care of significant digits in your work. Recheck your work before submitting it.
6) This assignment will remain valid **from January 1, 2020 to December 31, 2020**. However, you are advised to submit it **within 12 weeks** of receiving this booklet to accomplish its purpose as a teaching-tool.

We strongly recommend that you should retain a copy of your assignment response to avoid any unforeseen situation.

We wish you good luck.

Tutor Marked Assignment
Astronomy and Astrophysics (PHE-15)

Course Code: PHE-15
Assignment Code: PHE-15/TMA/2020
Max. Marks: 100

Note: Attempt all questions. Answer in your own words. Symbols have their usual meanings. The marks for each question are indicated against it.

---

1. (a) The distance of a planet from a star is 10 AU. Express this distance in light year and parsec. (5)

   (b) Calculate the ratio of the surface temperatures of the stars 1 and 2 from the following data:

Star	Absolute magnitude	Radius (R_Θ)
1	3	72
2	8	6

(5)

2. (a) Show the horizon coordinates of a star X on a celestial sphere for a location at latitude 60° N. Would these coordinates be the same at latitude 30° N? (4+1)

   (b) Why do X-ray telescopes need to be placed beyond the Earth's atmosphere? Which telescope, optical or X-ray, would have higher resolving power for the same aperture? Calculate the magnitude of the faintest object that a 100 m optical telescope can detect. (1+1+3)

3. (a) A main sequence star has mass 2×10^{31} kg and radius 3×10^{9} m. Obtain an estimate of the average temperature throughout the star. Examine if Newton's theory would be adequate for the study of this star. (3 + 2)

   (b) Explain how sunspots survive for so long even though they are surrounded by hotter matter. (5)

4. (a) The mean distance of Mars from the Earth is 0.5 AU and its orbital period is 687 days. Calculate the orbital period of Jupiter given that its mean distance from the Earth is 4 AU. (5)

   (b) A star has surface temperature of 25000 K. Which lines would be prominent in its spectrum and why? (1+4)

5. (a) Derive the expression for the mean temperature in a star:

$$< T > \propto M^{2/3} < \rho >^{1/3}$$

   Will this result apply to a star which is not in equilibrium? (4+1)

   (b) The mean free path of photons in stars is of the order of 0.2 cm. Show that the time taken for a photon to reach the surface of a star of radius 4 R_Θ is of the order of one million year. (5)

6. (a) Describe the composition of the interstellar medium. Explain how it has been possible to map the HI clouds. (2+3)

(b) Write down the condition under which a large molecular cloud collapses to give rise to new stars. Calculate the time of free fall of an HI cloud of density 10^6 particles / m^3 if the collapse is adiabatic. (1+4)

7. (a) Explain the meaning of a degenerate gas. A white dwarf star has a mass of 10^{30} kg. Its luminosity is 10^{24} Js^{-1}. Calculate how long it can survive with its present luminosity if its internal temperature is 10^7 K. (2+3)

   (b) How long will a 5 $M_\odot$ star burn hydrogen as fuel, given that the Sun will do so for about 10^{10} years? (5)

8. (a) Obtain an expression for the radial velocity of objects in the galaxy as a function of their galactic longitude. (5)

   (b) What is an active galaxy? Describe the classification of active galaxies with examples. (1+4)

9. (a) Describe Hubble's classification scheme for galaxies with the help of a diagram. (5)

   (b) An electron is moving with a speed of $0.97c$ in a magnetic field of strength 10^8 G. Calculate the peak frequency at which the electron will radiate. (5)

10. (a) What is the evidence given in support of an evolving universe? (5)

    (b) If the temperature of the background radiation today is 3 K, at what time after the birth of the universe was the temperature 10^{15} K. Take the age of the universe as 15×10^9 years. (5)

******