

**ASSIGNMENT BOOKLET**  
**Bachelor's Degree Programme (B.Sc.)**

**ASTRONOMY AND ASTROPHYSICS**

**Valid from January 1, 2023 to December 31, 2023**

**It is compulsory to submit the Assignment before filling up the  
Term-End Examination Form.**

**Please Note**

- You can take electives (56 or 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 out of those 64 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 responsibility will be yours.



**School of Sciences**  
**Indira Gandhi National Open University**  
**Maidan Garhi, New Delhi-110068**

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:

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ENROLMENT NO.: .....

NAME : .....

ADDRESS : .....

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COURSE CODE: .....

COURSE TITLE : .....

ASSIGNMENT NO. ....

STUDY CENTRE: ..... DATE:.....

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**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, 2023 to December 31, 2023**. 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/2023  
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.**

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1. a) The distance modulus of a star is  $-0.1$ . At what distance is it from the earth? (5)
- b) After about 1 billion year, the radius of a star is expected to increase by 100 times its present radius. If its temperature becomes half of what it is today, determine the change in its absolute magnitude. (5)
- c) Explain the following terms with the help of a diagram, wherever needed: celestial sphere, zenith, circumpolar stars, diurnal circle, resolving power of a telescope. (3×5)
2. a) A main sequence star has mass  $2 \times 10^{31}$  kg and radius  $3 \times 10^9$  m. Obtain an estimate of the average temperature throughout the star. (5)
- b) Explain how sunspots survive for so long even though they are surrounded by hotter matter. (5)
- c) The mean distance of Mars from the Earth is 0.5 A.U. and its orbital period is 687 days. Calculate the orbital period of Jupiter given that its mean distance from the Earth is 4 A.U. (5)
- d) A star has surface temperature of 25000 K. Which lines would be prominent in its spectrum and why? (5)
- e) Derive the following expression for the mean temperature in a star:
$$\langle T \rangle \propto M^{2/3} \langle \rho \rangle^{1/3} \quad (5)$$
3. a) Describe the composition of the interstellar medium. Explain how it has been possible to map the HI clouds. (5)
- b) Derive an expression for Jeans mass and discuss its significance in the formation of stars. (7+3)
- c) A white dwarf star has a mass of  $10^{30}$  kg. Its luminosity is  $10^{24}$  Js<sup>-1</sup>. Calculate how long it can survive with its present luminosity if its internal temperature is  $10^7$  K. (5)
- d) How long will a  $5M_{\odot}$  star burn hydrogen as fuel, given that the Sun will do so for about  $10^{10}$  years? (5)

4. a) Distinguish between elliptical and spiral galaxies and give one example of each type of galaxy. (5)
- b) What is an active galaxy? What is the source of its activity? Under what conditions does an active galaxy emit synchrotron radiation? (3+3+4)
- c) What do you understand by cosmic distance ladder? Explain how it is used to estimate distance of stars. (10)

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