PHE-15

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

ASTRONOMY AND ASTROPHYSICS

Valid from January 1, 2021 to December 31, 2021

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

2021

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 :……

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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, 2021 to December 31, 2021**. 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/2021
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) Express the distances of the stars Sirius *A* and Antares from the Earth in light years. (5)

   b) What is meant by the apparent magnitude of a star? How is it related to the brightness of the star? An object *A* has an apparent magnitude of –5. Another object *B* has an apparent magnitude of –10. Calculate the ratio of their brightness. (1+1+3)

   c) Sketch the celestial equator, horizon, observer's meridian and show the zenith and nadir on the celestial sphere for an observer at latitude 30° N. (5)

   d) The latitude and longitude (in degrees) of Mumbai and Shillong are as follows:

   Mumbai: latitude 19 N longitude 73 E
   Shillong: latitude 26 N longitude 92 E.

   When it is 12:00 O'clock local time at Shillong, what is the local time in Mumbai? (5)

   e) The average density of a white dwarf of radius 10^9 cm is 10^6 gm/cm^3. Is general theory of relativity needed to study the dynamics of this star? What happens if the star shrinks to a radius thousand times smaller? (5)

2. a) What is the nature of radiation generated in the Sun's interior? How does it differ from the radiation we receive from the Sun? What causes granulation of the photosphere? (1+1+3)

   b) Explain helioseismology. How does it help in understanding the internal structure of the Sun? (2+3)

   c) What are the main differences between the terrestrial and jovian planets? How does the ring system of jovian planets persist for so long? (3+2)

   d) What is solar nebula? Explain the formation of nebular disk. (2+3)

   e) What are the characteristic features of the H II region of ISM? How is it different from the molecular cloud? (1+4)

3. a) Explain the concept of degeneracy pressure. What role does it play in the evolution of a star after its death? (3+2)

   b) What is planetary nebula? Explain the concept of Chandrasekhar limit. (2+3)

   c) The mass and radius of a neutron star is $2M_\Theta$ and 15 km, respectively. Calculate the value of gravitational red shift for light of wavelength 6000 Å at a distance of 2 m from its surface. (5)

   d) Explain the difference between rigid body rotation and Keplerian motion. What is galactic longitude? (4+1)

e) Discuss the rotation curve of our Galaxy. What inferences can be drawn from it about the structure of our Galaxy? (3+2)

4. a) Explain Hubble's scheme of galaxy classification with the help of a diagram. Describe the prominent features of spiral galaxies. (5+5)

b) Calculate the half-width of a spectral line of wavelength $\lambda = 550$ nm when the temperature of the gas is 6×10^5 K. Assume H atoms to be emitters. (5)

c) Describe the nature of the central engine in an AGN. (5)

d) Explain the need to postulate the existence of dark matter in the universe. (5)

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