

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

ELEMENTARY MECHANICS

Valid from January 1, 2025 to December 31, 2025

**It is compulsory to submit the Assignment before filling in 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

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 in the Programme Guide for Elective Courses 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 for this course.

Instructions for Formatting Your Assignments

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, 2025 to December 31, 2025.** However, you are advised to submit it within **12 weeks** of receiving this booklet to accomplish its purpose as a teaching-tool. Answer sheets received after the due date shall not be accepted.

We strongly feel that you should retain a copy of your assignment response to avoid any unforeseen situation and append, if possible, a photocopy of this booklet with your response.

We wish you good luck.

Tutor Marked Assignment
ELEMENTARY MECHANICS

Course Code: BPHE-101/PHE-01
Assignment Code: BPHE-101/PHE-01/TMA/2025
Max. Marks: 100

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

1. A crate of mass 30.0 kg is pulled by a force of 300 N up an inclined plane which makes an angle of 30° with the horizon. The coefficient of kinetic friction between the plane and the crate is $\mu_k = 0.225$. If the crates starts from rest, calculate its speed after it has been pulled 15.0 m. Draw the free body diagram. (10)
2. A ball having a mass of 0.5 kg is moving towards the east with a speed of 8.0 ms^{-1} . After being hit by a bat it changes its direction and starts moving towards the north with a speed of 6.0 ms^{-1} . If the time of impact is 0.1 s, calculate the impulse and average force acting on the ball. (10)
3. A box of mass 8.0 kg slides at a speed of 10 ms^{-1} across a smooth level floor before it encounters a rough patch of length 3.0 m. The frictional force on the box due to this part of the floor is 70 N. What is the speed of the box when it leaves this rough surface? What length of the rough surface would bring the box completely to rest? (10)
4. A wheel 2.0 m in diameter lies in the vertical plane and rotates about its central axis with a constant angular acceleration of 4.0 rad s^{-2} . The wheel starts at rest at $t = 0$ and the radius vector of a point A on the wheel makes an angle of 60° with the horizontal at this instant. Calculate the angular speed of the wheel, the angular position of the point A and the total acceleration at $t = 2.0\text{s}$. (10)
5. A horizontal rod with a mass of 10 kg and length 12 m is hinged to a wall at one end and supported by a cable which makes an angle of 30° with the rod at its other end. Calculate the tension in the cable and the force exerted by the hinge. (10)
6. A girl is sitting with her dog at the left end of a boat of length 10.0 m. The mass of the girl, her dog and the boat are 60.0 kg, 30.0 kg and 100.0 kg respectively. The boat is at rest in the middle of the lake. Calculate the centre of mass of the system. If the dog moves to the other end of the boat, the girl staying at the same place, how far and in what direction does the boat move? (10)
7. A child of mass 50 kg is standing on the edge of a merry go round of mass 250 kg and radius 3.0 m which is rotating with an angular velocity of 3.0 rad s^{-1} . The child then starts walking towards the centre of the merry go round. What will be the final angular velocity of the merry go round when the child reaches the centre? (10)
8. At a crossing a truck travelling towards the north collides with a car travelling towards the east. After the collision the car and the truck stick together and move off at an angle of 30° east of north. If the speed of the car before the collision was 20 ms^{-1} , and the mass of the truck is twice the mass of the car, calculate the speed of the truck before and after the collision. (10)

9. Titan, a satellite of Saturn, has a mean orbital radius of 1.22×10^9 m. The orbital period of Titan is 15.95 days. Hyperion, another satellite of Saturn, orbits at a mean radius of 1.48×10^9 m. Estimate the orbital period of Hyperion. (10)
10. a) What should be the angular velocity of the earth such that a person of mass 80 kg standing on the earth at the equator would actually fly off the earth? (5)
- b) A ball of mass 60g is moving due south with a speed of 50 ms^{-1} at latitude 30°N . Calculate the magnitude and direction of the coriolis force on the ball. (5)
