BPHE-101/PHE-01

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

ELEMENTARY MECHANICS

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 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.**

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THE PEOPLE'S
UNIVERSITY

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 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 : ………………………………………

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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. 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
Assignment Code: BPHE-101/PHE-01/TMA/2021
Max. Marks: 100

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

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1. A crate of mass 40.0 kg is pulled by a force of 2000 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 $\mu_k = 0.20$. If the crates starts from rest, calculate its speed after it has been pulled 10.0 m. Draw the free body diagram. Take $g = 10.0\,\mathrm{ms}^{-2}$. (10)

2. A car is traveling towards the east at a speed of $10.0\,\mathrm{ms}^{-1}$. It then turns towards the north and continues to travel at the same speed. If the turn is made in a time of 5.0 s and the mass of the car is 2000 kg, calculate (i) the impulse delivered to the car because of the turn and (ii) the average force exerted on the car during the turn. (10)

3. A box of mass 15 kg is sliding along a smooth floor with a velocity of $15.0\,\mathrm{ms}^{-1}$. It then enters a rough portion which has a length of 6.0 m. In this portion of the floor, a frictional force of 80.0 N acts on the box. Determine (i) the work done by the frictional force on the box? (ii) the velocity of the box when it leaves the rough surface and (iii) the length of the rough surface required to bring the box completely to rest. Take $g = 10.0\,\mathrm{ms}^{-2}$. (10)

4. A merry-go-round is initially at rest. On being given a constant angular acceleration it reaches an angular speed of $0.50\,\mathrm{rad\,s}^{-1}$ in 10.0 s. At t = 10.0 s, determine the magnitude of: (i) the angular acceleration of the merry-go-round ; (ii) the linear velocity of a child sitting on the merry-go-round at a distance of 3.0 m from its centre; (iii) the tangential acceleration of the child; (iv) the centripetal acceleration of the child; and (v) the net acceleration of the child. (10)

5. A horizontal rod with a mass of 15 kg and length 10 m is hinged to a wall and supported by a cable which makes an angle of 30° with the rod. Calculate the tension in the cable, and the force exerted by the pivot. (10)

6. Three particles of equal masses m are placed at the vertices of an equilateral triangle of side 2.0 m. Determine the centre of mass of this system. (10)

7. A disc rotates with a period of 0.50s. Its moment of inertia about its axis of rotation is $0.08\,\mathrm{kg\,m}^2$. A small mass is dropped onto the disc and rotates with it. The moment of inertia of the mass about the axis of rotation is $0.02\,\mathrm{kg\,m}^2$. Determine the final period of the rotating disc and mass system. (10)

8. A particle of mass $3m$ initially moving with a speed u in the positive x-direction collides with a second particle of mass m moving in the opposite direction with an unknown speed v. After collision the mass $3m$ moves along the negative y-direction with a speed $u/2$ and the mass m moves with a speed v' in a direction making an angle of 45° with the positive x-direction. Determine v and v' in units of u. Is the collision elastic? (10)

9. A satellite of mass 2500 kg is orbiting the Earth in an elliptical orbit. At the apagee, the altitude of the satellite is 3000 km, while at the perigee its altitude is 1000 km. Calculate the energy and angular momentum of the satellite and its speed at the apagee and perigee. (10)

10. a) What is the effective weight of a person of mass 75 kg carried vertically up in a rocket with an acceleration of $1.5g$? (5)

b) A particle is being rotated in a centrifuge which has a radius of 5.0 m. If the particle's centripetal acceleration is 4 g, determine its speed. What is the time period of its motion? (5)

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