MPH-014

ASSIGNMENT BOOKLET

M.Sc. (Physics) Programme
(MSCPH)

COMPUTATIONAL PHYSICS

Valid from 1st July, 2024 to 30th June, 2025

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2024-25)

Dear Student,

Please read the section on assignments in the Programme Guide for M.Sc. (Physics). 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. The assignment is in this booklet. The total marks for this assignment is 50, of which 20 marks are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

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

ENROLMENT NO.: …..……

NAME: ……

ADDRESS: ……

COURSE CODE:……..

COURSE TITLE: ……

ASSIGNMENT CODE: ……..

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) **Submit the complete assignment answer sheet within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **Answer sheets received after the due date shall not be accepted. We strongly suggest that you retain a copy of your answer sheets.**

7) This assignment is **valid from 1st July 2024 to 30th June 2025**. If you have failed in this assignment or fail to submit it by June 30, 2025, then you need to get the assignment for the year 2025-26, and submit it as per the instructions given in the Programme Guide.

8) **You cannot fill the examination form for this course** until you have submitted this assignment. For any queries, please contact: mbnewmai@ignou.ac.in, slamba@ignou.ac.in

We wish you good luck.

Tutor Marked Assignment
COMPUTATIONAL PHYSICS

Course Code: MPH-014
Assignment Code: MPH-014/TMA/2024-25
Max. Marks: 50

Note: Attempt all questions. The marks for each question are indicated against it.

1. a) Define true error and relative true error.

   b) The approximate value of the derivative of a function $f(x)$ at x can be calculated using the formula: $\frac{df(x)}{dx} = \frac{f(x+h)-f(x)}{h}$

   Calculate $\frac{df(x)}{dx}$ at $x = 2$ for $f(x) = 2x^2 + \exp(3x)$ for (i) $h = 0.5$ and (ii) $h = 0.05$.

   Determine the true error and relative true error in each case. (2+8)

2. a) Use the bisection method in the interval [2,4] to calculate the root/s of the equation $f(x) = x^3 - 20$ up to three iterations. Calculate the absolute relative approximate error at each stage.

   b) What are the advantages and drawbacks of the bisection method?

   c) In what way is the Newton-Raphson method more beneficial than the bisection method? (5+3+2)

3. a) Given the following data for the velocity as a function of time, calculate the velocity at $t = 12$ s using second order polynomial interpolation in the Newton divided difference method:

Time (in s)	0	15	18	22	24
Velocity (in ms^{-1})	20	25	35	30	80

   b) Explain why one should not use higher order polynomial interpolation. What would be a preferable method of using information from several data points for interpolation? (7+3)

4. a) Using the trapezoidal rule, estimate the value of the integral $\int_1^2 3x\exp(-x)dx$ and the true error.

   b) Use Euler's method for the differential equation $\frac{dy}{dx} + y = \exp(-x)$, with the initial condition $y(0) = 2$ to calculate $y(2)$. Take a value of step size $h = 0.5$. (5+5)

5. a) Determine the first eight random numbers generated by using the linear congruential random number generator with a=c=7 and m=10. What is the period of this random number sequence.

   b) Use the Gauss elimination method to solve the system of equations:
   $x_1 - 2x_2 + x_3 = 0\,; 2x_1 + x_2 - 3x_3 = 5\,; 4x_1 - 7x_2 + x_3 = -1$ (5+5)

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