



NATIONAL OPEN UNIVERSITY OF NIGERIA  
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA  
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

OCT/NOV 2019 EXAMINATIONS

**COURSE CODE:** PHY 314  
**COURSE TITLE:** NUMERICAL COMPUTATIONS  
**CREDIT UNIT:** 2  
**TIME ALLOWED:** (2 HRS)

**INSTRUCTION:** Answer question 1 and any other three questions

**QUESTION 1**

- (a) Write short notes on the following types of errors
- (i) Rounding Errors 3marks
  - (ii) Inherent Errors 3marks
  - (iii) Truncation Errors 3marks
- (b) Give four (4) methods of solving first order ordinary differential equations. 4 marks
- (c) Write the modified Euler method formula. 2 marks
- (d) A length of copper wire whose actual length is 26.5 was measured to be 26.3cm.  
Calculate:
- i) the absolute error 3marks
  - ii) relative error 3marks
  - iii) percentage error 4marks

**QUESTION 2**

- a) A student performing the simple pendulum experiment obtained the following results, where  $t$  is the time for 50 oscillations. 6 marks

l(cm)	50	45	40	35	30	25	20	1571
t(s)	71	69	65	61	56	52	48	43

Find the acceleration due to gravity at the location of the experiment, using

- (a) The method of least squares, and
- (b) The method of group averages. 3 marks

- (c) Solve the system of linear equations  $x + 2y + 2z = -2$ ,  $2x + 2y + z = -4$ ,  
 $9x + 6y + 2z = -14$  using the method of
- (i) Gaussian elimination 3 marks  
(ii) Gauss-Jordan elimination 3 marks

**QUESTION 3**

Find a root of the equation  $2x^3 - 3x^2 - 2x - 0.5$  using the following methods

- (a) Newton-Raphson starting point 2.0 3 marks  
(b) Regula-falsi [starting points 1.9 and 2.1]. 3 marks  
(c) Secant [starting points 1.9 and 2.1]. 6 marks  
(d) Find a root of the equation  $x - 2\sin x$  using bisection method, given that the root is  
between 1.5 and 3, with tolerance  $|f(x)| \leq 0.02$ . 3 marks

**QUESTION 4**

- (a) Give two (2) demerits of the newton-raphson method. 4 marks  
(b) Give two (2) demerits of the Bisection Method. 3 marks  
(c) Find the upper bound of the error you are likely to incur in using the bisection  
method in finding the root of an equation if the two starting points are 1.4 and 2.5  
and you needed 8 steps to achieve the required tolerance. 4 marks  
(d) Find a root of the equation  $2x^3 - 3x^2 - 2x - 0.5$  using the root bisection  
[starting points 1.9 and 2.1 (tolerance  $|f(x)| \leq 0.001$ )]. 4 marks

**QUESTION 5**

Using the set of data provided below carry out the

- (a) Forward differences. 3 marks  
(b) Backward differences. 3 marks

1	2	3	4	5	6	7
1	12	47	118	237	416	667

- (c) Evaluate the integral  $\int_0^{\pi/2} x \sin x dx$  (where  $x$  is in radians) with a step-size of  
 $\Delta x = \pi/16$  using Trapezoidal rule. 4<sup>1/2</sup> marks  
(d) Using also Simpson's one-third rule for (Q 5c) above. 4<sup>1/2</sup> marks