



NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi-Abuja
FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2024 1 EXAMINATION

Course Code: MTH307

Course Title: Numerical Analysis II

Time Allowed: 3 Hours

Total: 70 Marks

Instructions: ATTEMPT QUESTION ONE (1) AND ANY OTHER THREE (3) QUESTIONS

1. Find a cubic approximation to e^x by using Chebyshev polynomials. **(25 marks)**
2. Given a continuous function e^x for $x \in [-1, 1]$, fit a linear polynomial $c_0 + c_1x$ to e^x and determine its root mean square error. **(15 marks)**
3. Integrate $y = \sqrt{x}$ within the limits 1.00 and 1.30 using Simpson's $\frac{1}{3}$ -rule with 7 ordinates and working with 5 decimal places. Hence, estimate the error of this method. **(15 marks)**
4. Obtain the solution to the partial differential equation at the first- and second-time levels only $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ $0 \leq x \leq 1$, $t \geq 0$ where
$$u(0, t) = 1, u(x, 0) = 1 + x \text{ and } \left. \frac{\partial u(x, t)}{\partial t} \right|_{x=1} = 0$$

Take $h = 0.2$ and $k = 0.02$. Use the classical explicit method. **(15 marks)**
5. Solve the boundary value problem $(1 + x^2)y'' + 4xy' + 2y = 2$; $y(0) = 0, y(1) = \frac{1}{2}$ using
 - (i) First order finite difference method. **(7 marks)**
 - (ii) Second order finite difference method. **(8 marks)**