NATIONAL OPEN UNIVERSITY OF NIGERIA

University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi-Abuja

FACULTY OF SCIENCES

Department of Mathematics

2021_2 Examinations

Course Code: MTH307

Course Title: Numerical Analysis II

Credit Unit: 3

Time Allowed: 3 Hours

Total: 70 Marks

Instruction: Answer Question One (1) and Any Other 4 Questions

1. (a) State the properties of Chebyshev polynomials. **(5 marks)**

   (b) Use Chebyshev interpolation to find a cubic polynomial approximation to $(1+x)^{\frac{1}{2}}$ over $[-1, 1]$. **(17 marks)**

2. (a) Distinguish between Initial Value Problem and Boundary Value Problem. **(5 marks)**

   (b) Solve the Boundary Value Problem (BVP) $(1+x^2)y'' + 2xy' - y = x^2$ with the boundary conditions $y(0) = 1$ and $y(1) = 0,$ using a step length of $0.25.$ **(7 marks)**

3. (a) State the properties of a cubic spline interpolation. **(5 marks)**

   (b) Use Hermite cubic interpolation to estimate the value of $\sqrt{55}$ taking $f(x) = \sqrt{x},\ x_1 = 49,\ x_2 = 64.$ **(7 marks)**

4. (a) Enumerate the classification of least square approximation method and explain each.

(5 marks)

(b) Derive the least square formula for discrete data. **(7 marks)**

5. (a) Distinguish between Hermite polynomial and cubic spline. **(5 marks)**

(b) Find the cubic spline given the data below

x	0	2	4	6
y	1	9	41	41

where $M_0 = 0$ and $M_3 = -12$. **(7 marks)**

6. (a) Define Simpson's $\frac{1}{3}$ rule. **(5 marks)**

(b) Evaluate $\int_0^{\frac{\pi}{3}} \sin x dx$ with $h = \frac{\pi}{12}$, correct to 5 decimal places using Trapezoidal rule.

(7 marks)