NATIONAL OEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja

FACULTY OF SCIENCES
April/May Examination 2019

Course Code: MTH382
Course Title: Mathematical Methods
Credit Unit: 3
Time Allowed: 3HOURS
Total: 70 Marks
Instruction: ATTEMPPT NUMBER ONE (1) AND ANY OTHER FOUR (4) QUESTIONS

(1) (a) Define the Bessel equation (5 Marks)

(b) Assume that V is not an integer in the Bessel equation then show that (15 Marks)

$$y = \sum_{n=0}^{\infty} c^m x^{m+r}$$

(c) Define a Periodic Function (2 Marks)

(2) Show that

$$(\alpha)_{2n} = 2^{2n}\left(\frac{\alpha}{2}\right)_n \left(\frac{\alpha+1}{2}\right)_n$$ (12 Marks)

(3) Prove that

$$\int_0^{\frac{\pi}{2}} J_0(z\cos\theta)\cos\theta d\theta = \frac{\sin z}{z}$$ (12 Marks)

(4) $exp\left\{\frac{1}{2}x(t-t^{-1})\right\} = \sum_{n=-\infty}^{\infty} \mathcal{T}_0(x)$ show that if n is an integer then

$$\mathcal{T}_n(x) = (\frac{1}{2}x)^n \sum_{r=0}^{\infty} \frac{\left(-x\cdot\frac{x^2}{4}\right)^r}{r!(n+r)!}$$ (12Marks)

(5) (a) Show that $P_2(x) = \frac{1}{2}(3x^2-1)$ by Rodrigues formula (6 Marks)

(b) Show that $P_n^1 + l(x) = (2n+1)P_n(x) + P_{n-1}^1(x), \quad n = 1,2,\ldots$ (6 Marks)

(6) Show that

(a) $2F(\alpha,\beta,\beta,x) = (1-x)^{-\alpha}$ (6 Marks)

(b) $2F(1;1;2;-x) = \log(1+x)$ (6 Marks)