NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja.

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2022_2 Examination

Course Code: MTH 382
Course Title: Mathematical Methods IV
Credit Unit: 3
Time allowed: 3 HOURS
Instruction: Answer Question One and any Other Three Questions

1. (a) Define Legendry function (3 marks)
(b) Prove that

$$P_n^1 + l(x) = xP_n^1(x) + (n+1)P_n(x)$$

(c) Define a Periodic Function
(d) Consider the Laplace equation in polar co-ordinates $u = \frac{1}{z}u_2\frac{1}{2} + u_2\frac{1}{z^2}u\theta\theta$ with boundary condition $u(a,\theta) = f(\theta)$ f is a given function on $0 \le \theta \le 2\pi$ in order that $u(z,0)$ the single value, it is necessary that a function of θ, show that u must be periodic with period 2π.
(2) Solve the Laplace equation

$$u_{xx} + u_{yy} = 0$$

In the rectangle $0 < x < \alpha, 0 < y < b$, and which satisfies the boundary condition.

$$u(x,0) = 0 \quad u(x,b) = 0 \quad 0 < x < a$$
$$u(0,y) = 0 \quad u(a,y) = f(y) \quad 0 \le y \le b$$

Where f is given function on $0 \le y \le b$

(3) (a) Define the Bessel equation

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

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

(4) Show that
(a) $2F(\alpha,\beta,\beta,x) = (1-x)^{-\alpha}$
(b) $2F(1;1;2;-x) = \log(1+x)$