NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JUNE/JULY EXAMINATION

COURSE CODE: MTH382
COURSE TITLE: MATHEMATICAL METHOD IV (3 units)
TIME ALLOWED: 3 HOURS
INSTRUCTION: ANSWER ANY 4 QUESTIONS

$$(1-x^2)y''-2xy'+n(n+1)y=0$$

1.(a) solve the legendre equation with singular point

$$1-x^2=0$$

$$x=\pm 1$$

o r

-10 marks

$$\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=8(x^2+e^{2x})$$

(b) Solve the differntial equation

-7 ½ marks

2.(a) Solve the differential equation by variation of parameters the equation

$$y''+y=\sec^3 x$$

- 7 ½ marks

$$(1+x^2)y''-4xy'+6y=0$$

(b) Solve the differential equation

-10 marks

3. (a) .Determine the regular singular point of the differential equation **- 10 marks**

$$P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx}(x^2-1)^n, n=1,2,3,....$$

(b)Given that Rodrigues formular ,show that

$$P_2(x)=\frac{1}{2}(3x^2-1)$$

-7 ½ marks

4.(a) Show that $\Gamma(n+1)=n!$

-7 ½ marks

(b)Evaluate (i) $\frac{\Gamma(3)\Gamma\left(\frac{5}{2}\right)}{\Gamma(5.5)}$ (ii) $\frac{\Gamma\left(\frac{-5}{2}\right)}{\Gamma(5)}$

-10 marks

5.(a) Use the definition of Gamma function,evaluate $\int_0^\infty x^6 e^{-2x}dx$

-7 ½ marks

(b) Prove that $\Gamma\left(\frac{-1}{2}\right)=\sqrt{\pi}$

-10 marks

6.(a) Solve the Bessel equation $x^2\frac{d^2y}{dx}+x\frac{dy}{dx}+(x^2-v^2)y=0$

- 10marks

(b) Evaluate $\int_0^1 x^4(1-x)^3dx$

-7 ½ marks