



NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
SCHOOL OF SCIENCE AND SCIENCES
MAY/JUNE 2012 EXAMINATION

MTH 382 MATHEMATICAL METHOD IV
TIME: 3 HOURS

INSTRUCTION: ANSWER ANY 5 QUESTIONS

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

1.(a) solve the legendre equation with singular

$1-x^2=0$ $x=\pm 1$
point o r -8 marks

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

(b) Solve the differntial equation -6marks

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

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

-6 marks

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

(b) Solve the differential equation -8 marks

3. (a) .Determine the regular singular point of the differential equation \mp

- 10 marks

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

(b) Given that Rodrigues formula $\quad \quad \quad$, show

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

that

-4 marks

4.(a) Show that $\Gamma(n+1) = n!$ -6 marks

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

-8 marks

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

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

-8 marks

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

- 10marks

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

-4 marks

7.(a) Solve the hypergeometric equation of form

$$x(1-x)y'' + [t - (r+s+1)x]y' - rsy = 0$$

-10 marks

$$x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 4x$$

-4 marks

(b) Solve the differential equation