NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JANUARY/FEBRUARY 2013 EXAMINATION

CODE:MTH 382
TIME: 3 HOURS
TITLE: MATHEMATICAL METHOD IVTOTAL: 70 MARKS
CREDIT UNIT: 3
INSTRUCTION: ANSWER ANY 5 QUESTIONS

1. (a) The gamma function of x is defined as $\Gamma(x)=\int_0^\infty t^{n-1}e^{-t}dx$ .Show that $\Gamma(x+1)=x\Gamma(x)$
-4 marks

(b) Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$ **-10 marks**

2. (a) The beta function of x is defined as $B(m,n)=\int_0^1 x^{m-1}(1-x)^{n-1}dx$ .prove that

$B(m,n)=2\int_0^{\pi/2}\sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta$ **6 marks**

(b) Use the definition of beta function of x in 2(a), evaluate (i) $\int_0^1 x^5(1-x)^6dx$ -
3 marks

(ii) $\int_0^1 x^4\sqrt{1-x^2}dx$ **-5 marks**

3. (a) The Rodrigues formula is given as $p_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$ where $n=1,2,3\ldots$,evaluate $p_4(x)$

- 7 marks

(b) Solve the second order differential equation $\frac{d^2y}{dx^2}+5\frac{dy}{dx}+6y=2x^2+5x$ **-7 marks**

4. (a) Find a series solution of the differential equation $y''+y=0$, **-8 marks**

(b) Determine the singular points of the differential equation

$2x(x-2)^2y''+3xy'+(x-2)y=0$

and classify them as regular or irregular **-6 marks**

5. (a) Given the Bessel equation as $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-v)y=0$,Solve the Bessel equation of order

zero -**10 marks**

(b) Find the solution of the initial value problem $y''+y'-6y=0$, $y(0)=2, y'(0)=3$ **-4 marks**

6. (a) Solve the hypergeometric equation of form $x(1-x)y"+[t-(r+s+1)x]y'-rsy=0$

-**10 markssss**

(b) Solve the differential equation $x\frac{d^2y}{dx^2}+\frac{dy}{dx}=4x$ -**4 marks**

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

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

-**6 marks**

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

(b) Solve the differential equation -**8 marks**

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