



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

CODE: MTH 381

TIME: 3 HOURS

TITLE: MATHEMATICAL METHOD III TOTAL: 70 MARKS

CREDIT UNIT: 3

INSTRUCTION: ANSWERS ANY 5 QUESTIONS

1.(a) The Laplace transform of an expression $f(t)$ is definition as

$$L[f(t)] = \int_{t=0}^{\infty} f(t)e^{-st} dt, \text{ show that}$$

$$L[\sinh at] = \frac{a}{s^2 - a^2}$$

-6 marks

(b) Evaluate (i) $L[2e^{-t} + t]$

-4 marks

(ii) $L[2 \sin 3t + \cos 3t]$

-4 marks

2. (a) Evaluate the integral $\int_0^1 \int_0^1 (x^2 + y^2) dy dx$

-4 marks

(b) (i) Evaluate $\int_c (x+3y) dy$ from $A(0,1)$ to $B(2,5)$ along the curve $y=1+x^2$. -6 marks

(ii) Evaluate the line integral $I = \int_c (x^2 dx - 2xy dy)$ where c comprises the three sides of the triangle

joining $O(0,0)$, $A(1,0)$ and $B(0,1)$. -6 marks

3. (a) Verify Green's theorem in the plane for $\oint_c (xy + y^2) dx + x^2 dy$, where C is the closed curve of the region

bounded by $y=x$ and $y=x^2$ -7 marks

(b) Evaluate $I = \oint_c [(2x-y)dx + (2y+x)dy]$ around the boundary c of the ellipse $x^2 + 9y^2 = 16$ -7 marks

4. (a) Find the area of the surface $z = \sqrt{x^2 + y^2}$ over the region bounded by $x^2 + y^2 = 1$ -8 marks

(b) Find the volume of the solid bounded by the planes

$$z=0, x=0, y=0, x^2+y^2=4 \text{ and } z=6-xy \text{ for } x \geq 0, y \geq 0, z \geq 0$$

-6 marks

5. (a) Evaluate $\iint_S F \cdot n ds$, where $F=4xzi - y^2j + yzk$ and S is the surface of the cube bounded by

$$x=0, x=1, y=0, y=1, z=0, z=1$$

-8 marks

(b) Find the fourier coefficient of the periodic function f where

$$f(x) = \begin{cases} -1 & \text{if } -\pi < x < 0 \\ 1 & \text{if } 0 < x < \pi \end{cases} \text{ and } f(x+2\pi) = f(x)$$

-6marks

6. (a) State stoke's theorem and express it in rectangular form -6 marks

$$\int_{-\frac{r}{2}}^{\frac{r}{2}} \int_0^{2\cos\theta} r^2 dr d\theta$$

(b) Evaluate the integral

-8 marks

7. (a) Express the divergence theorem in words and write it in rectangular form -6 marks|

(b) Solve by laplace transform the differential equation

$$y''' - 4y'' + 4y = 4e^{2t}, \text{ given that}$$

$$y(0) = -1, y'(0) = -4$$

-8 marks

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