University Of Technology
Building and Construction Eng. Dept.
Final Exam – First Attempt – 2010/2011

Subject : Mathematics | Class: 2nd year
Branch : All branches | Time : 3 Hours

Date : 5 / 6 / 2010

NOTE: Answer ***EIGHT*** questions only, ***Q1 included***

Q1: Use the undetermined coefficients method to find the general solution of the following differential equation : $y'' + 2y' = x^2 - e^x$. *(16 marks)*

Q2: Given the vectors $\vec{U} = i - j + k$, $\vec{V} = 2i + j - 2k$, and $\vec{W} = -i + 2j - k$. Verify that $(\vec{U} \times \vec{V}).\vec{W} = (\vec{V} \times \vec{W}).\vec{U} = (\vec{W} \times \vec{U}).\vec{V}$, then find the volume of the box whose edges are determined by the vectors $\vec{U}$, $\vec{V}$ *and* $\vec{W}$. *(12 marks)*

Q3: Find the nature of the following infinite series : *(12 marks)*

$$\sum_{n=1}^{\infty} \frac{5n^4 - 1}{n^4 + 8n^3}$$

Q4: Solve the following differential equation : $\frac{dy}{dx} = -\frac{\ln y + \frac{y}{x}}{\ln x + \frac{x}{y}}$ *(12 marks)*

Q5: If $z = x + iy$,find the values of x, y and $\theta = arg.z$ for : $e^z = 1 + \sqrt{3}\, i$ *(12 marks)*

Q6: Use triple integrals to find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$. *(12 marks)*

Q7: Find the values of x, y, z *and* a which satisfies the following matrix equation : *(12 marks)*

$$\begin{bmatrix} x+3 & 2y+x \\ z-1 & 4a-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2a \end{bmatrix}$$

Q8: Find the direction in which the function $f(x,y) = x^2 + \cos xy$ starting from point $\left(1, \frac{\pi}{2}\right)$ in order to make (f) increase most rapidly, then find the derivative of (f) in that direction . *(12 marks)*

Q9: Change to polar form and evaluate $\iint_R e^{x^2+y^2}.dy.dx$ where R is the semicircular region bounded by the line $y = 0$ and the curve $y = \sqrt{1 - x^2}$. *(12 marks)*

Q10: If $w = a.\tan(x^2 + 1) - b.y.x^2 + c.y.\ln z^2$ where $x = 2t^2$ $y = 2e^{t-2}$ $z = 2t^2 - 2e^{t-2}$ and $w_y = -53.25$, $w_z = 2$ *and* $w_t = 945.6$. Use chain rule method to find the constants a, b *and* c *at* $t = 2$. *(12 marks)*