



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

Subject : Mathematics
Branch : All branches

Class: 2nd year
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 $(\vec{U} \times \vec{V}) \cdot \vec{W} = (\vec{V} \times \vec{W}) \cdot \vec{U} = (\vec{W} \times \vec{U}) \cdot \vec{V}$, 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 $(1, \frac{\pi}{2})$ 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 $\iint_R e^{x^2+y^2} \cdot dy \cdot dx$ where R is the semicircular region bounded by the line $y = 0$ and the curve $y = \sqrt{1 - x^2}$. (12 marks)

Q10: If $w = a \cdot \tan(x^2 + 1) - b \cdot y \cdot x^2 + c \cdot y \cdot \ln z^2$ 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)