01584

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2011

BME - 015 : ENGINEERING MATHEMATICS-II

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **ten** of the following questions. All questions carry **equal** marks. Use of calculator is permitted.*

1. Test the convergence or divergence of the series 7

$$\sum_{n=1}^{\alpha} \left[\sqrt[3]{(n^3+1)} - n\right]$$

2. Discuss the convergence of the series 7

$$x + \frac{2^2 x^2}{2!} + \frac{3^3 x^3}{3!} + \frac{4^4 x^4}{4!} + \frac{5^5 x^5}{5!} + \cdots \alpha$$

3. Find the half-range cosine series for the function 7
$f(x) = (x-1)^2$ in the interval $0 < x < 1$
Hence show that :

$$\pi^2 = 8\left(\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots\right)$$

4. $f(x) = x + x^2$ for $-\pi < x < \pi$, and $f(x) = \pi^2$ for $x = \pm\pi$ 7

Expand $f(x)$ in Fourier series.

5. If $2\cos\theta = x + \frac{1}{x}$ and $2\cos\phi = y + \frac{1}{y}$, show that one of the values of 7

$$\frac{x^m}{y^n} + \frac{y^n}{x^m} \text{ is } 2\cos(m\theta - n\phi).$$

6. (a) Solve the following equations for the real numbers x and y 4+3

$$\frac{(1+i)\,x - 2i}{3+i} + \frac{(2+3i)\,y + i}{3-i} = i$$

(b) Solve for θ such that the expression

$$\frac{3 + 2i\sin\theta}{1 - 2i\sin\theta} \text{ is imaginary.}$$

7. If $\omega = \phi + i\psi$ represents the complex potential for an electric field and 7

$$\psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$$ determine the function ϕ.

8. Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $\omega = 0, 1, \infty$. 7

9. Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the region $1 < |z| < 2$. 7

10. Determine the poles of the following functions and the residue at each pole : $\frac{z^2 - 2z}{(z+1)^2 (z^2+1)}$ 7

11. The rate at which bacteria multiply is proportional to the instantaneous number present. If the original number doubles in 2 hours, in how many hours will it triple ? 7

12. Solve $\frac{dy}{dx} = \frac{y + \sqrt{x^2 + y^2}}{x}$ 7

13. Solve 7

$$(x^2 - yz)\, p + (y^2 - zx)\, q = z^2 - xy$$

14. Solve 7

$$(D^3 - 7\, DD'^2 - 6\, D'^3)\, z = \sin(x + 2y) + e^{2x+y}$$

15. Obtain the solution of the wave equation 7

$$\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$$

using the method of separation of variables.