No. of Printed Pages : **3** **BME-015**

00574

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2010

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.*

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1. Examine the convergence of the series :

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

2. Examine the convergence or divergence of the following series (stating conditions on x).

$$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots$$

3. Expand

$$f(x) = x \text{ Sin } x \quad , \quad 0 < x < 2\pi.$$

as a Fourier series.

4. Obtain the Fourier series for the function

$$f(x) = x^2, \qquad -\pi < x < \pi.$$

Hence find the value of $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots.$

5. Solve :

$$\frac{dy}{dx} = (4x + y + 1)^2$$

6. Solve :

$$\frac{dx}{x^2 - y^2 - z^2} = \frac{dy}{2xy} = \frac{dz}{2xz}$$

7. 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 ?

8. Solve :

$$\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} - Sin\, x\ Cos\ 2y$$

9. If $x + \frac{1}{x} = 2\ Cos\ \theta,\ y + \frac{1}{y} = 2\ Cos\ \phi$, find one of the values of $x^m y^n + \frac{1}{x^m y^n}$.

10. If $f(z) = u + iv$ is an analytic function, find $f(z)$ if $u - v = e^x (Cos\ y - Sin\ y)$.

11. Determine the analytic function whose real part is $log \sqrt{x^2 + y^2}$.

12. Prove that $\int_C \frac{dz}{z - a} = 2\pi i$ where C is the circle $|z - a| = r$.

13. Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = 0, 1, \propto$.

14. Evaluate $\oint_C \frac{e^{-z}}{z + 1} dz$, where C is the circle, $|z| = \frac{1}{2}$.

15. Determine the poles of the function

$$f(z) = \frac{z^2}{(z - 1)(z - 2)^2}$$

and find the residue at each pole.