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BME-015

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

J1158

Term-End Examination

June, 2014

BME-015 : ENGINEERING MATHEMATICS-II

Time : 3 hours *Maximum Marks : 70*

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

1. Discuss the convergence of the following series : 7

$$\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \ldots \infty$$

2. Test for convergence of the following series : 7

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

3. If $f(x) = \begin{cases} 0 & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$, and

$f(x + 2\pi) = f(x)$,

obtain the Fourier series. 7

4. If $f(x) = x^2$, $-\pi < x < \pi$, and $f(x + 2\pi) = f(x)$, determine the Fourier series for $f(x)$. 7

5. Find real numbers x and y so that $z_1 = z_2$, where $z_1 = x^4 + i(2x - y)$; $z_2 = (3x^2 + 4) + i(2y - 5)$. 7

6. If α, β be the roots of $x^2 - 2x + 4 = 0$, prove that $\alpha^n + \beta^n = 2^{n+1} \cos \frac{n\pi}{3}$. 7

7. If $2 \cos \theta = x + \frac{1}{x}$ and $2 \cos \phi = y + \frac{1}{y}$, show that one of the values of $\frac{x^m}{y^n} + \frac{y^n}{x^m}$ is $2 \cos (m\theta - n\phi)$. 7

8. If $\sin^{-1}(x + iy) = \log (A + iB)$, show that

$$\frac{x^2}{\sin^2 u} - \frac{y^2}{\cos^2 u} = 1,$$

where $A^2 + B^2 = e^{2u}$. 7

9. If $w = \phi + i\psi$ represents the complex potential for an electric field and $\psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$, determine the function ϕ. 7

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

11. Determine the poles of the function

$f(z) = \dfrac{z^2}{(z-1)^2 (z+2)}$ and the residue at each pole. 7

12. Solve : 7

$$\frac{\partial^3 z}{\partial x^3} - 2\frac{\partial^3 z}{\partial x^2 \partial y} = 2e^{2x} + 3x^2 y$$

13. Solve : 7

$$(x^2 - y^2 - z^2)\, p + 2xyq = 2xz$$

14. Solve : 7

$$(D^2 - 4D + 4)\, y = x^3 e^{2x}$$

15. Solve : 7

$$\tan y \frac{dy}{dx} + \tan x = \cos y \cos^2 x$$