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BME-015

03489

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2012

BME-015 : ENGINEERING MATHEMATICS-II

Time : 3 hours *Maximum Marks : **100***

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

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1. Test the convergence or divergence of the series

$$\frac{\sqrt{2-1}}{3^3-1} + \frac{\sqrt{3-1}}{4^3-1} + \frac{\sqrt{4-1}}{5^3-1} + \frac{\sqrt{5-1}}{6^3-1} + \cdots\cdots$$

2. Find the general solution of $y'' + xy' - x^2y = 0$ in the form of power series in powers of x.

3. Find the radius of convergence of the series

$$\frac{1}{2}x + \frac{1.3}{2.5}x^2 + \frac{1.3.5}{2.5.8}x^3 + \cdots\cdots$$

4. Show that for $-\pi < x < \pi$

$$\sin ax = \frac{2\sin a\pi}{\pi}\left(\frac{\sin x}{1^2-a^2} - \frac{2\sin 2x}{2^2-a^2} + \frac{3\sin 3x}{3^2-a^2} - \cdots\cdots\right)$$

5. Find a series of cosines of multiple of x which will represent $x \sin x$ in the interval $(0, \pi)$.

6. If n is positive integer, prove that

$$\left(1 + i\sqrt{3}\right)^n - \left(1 - i\sqrt{3}\right)^n = 2^{n+1} \cos n\pi/3$$ and Hence find the value when $n = 9$.

7. 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.

8. Obtain the Lament's series expansion of $\frac{e^z}{z\left(z^2+1\right)}, 0 < |z| < 1$.

9. Evaluate the following integrals by contour integration $\int_0^{2\pi} \frac{d\theta}{(a+b\cos\theta)^2}$ $a > b > 0$

10. Prove that :

$$\int_0^{\pi} \frac{a\, d\theta}{a^2 \sin^2\theta} = \frac{\pi}{\sqrt{1 + a^2}}, a > 0$$

11. Evaluate :

$$\int_0^{\alpha} \frac{x^{a-1}}{x^2+x+1}\, dx,\ 0 < a < 2$$

12. Find a transformation which will map a 60° sector of the unit circle in 2 - plane in to the upper half of the w-plane.

13. Find the general solution of $9\,y'' - 6y' + y = 0$

14. Use the method of laplace transforms to find the solution of

$y'' + ay = 6 \cos 3t,$

$y\,(0) = 2,\ y'\,(0) = 0$

15. Find the solution of the heat conduction problem

$U_{xx} = 4\,U_t \quad 0 < x < 2 \quad t > 0$

$U\,(0, t) = 0 = u\,(2, t) \quad t \geq 0$

$$U\,(x, 0) = 2 \sin \frac{\pi x}{2} - \sin \pi x + 4 \sin 2\pi x$$