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**BME-015**

# B.TECH. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

## Term-End Examination, 2019

## BME-015 : ENGINEERING MATHEMATICS-II

**Time : 3 Hours** | **Maximum Marks : 70**

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

1. Find the temperature u(x, t) in a bar of length $\pi$ which is perfectly insolated; also at the ends $x = 0$ and $x = \pi$ assume that $c = 1$ and $u(x, 0) = x$, (formulate the problem and use method of separation of variables for finding the solutions). [7]

2. Find a series solution near $x = 0$ of the differential equation

$$9x(1-x)\frac{d^2y}{dx^2} - 12\ \frac{dy}{dx} + 4y = 0$$ [7]

3. Solve $(D^2 - D'^2 - 3D + 3D')z = e^{x-2y}$ [7]

4. Solve, using Lagrange's method : [7]

$\cos(x+y)p + \sin(x+y)q - z = 0$

5. Solve $(D^3 - 2D^2 - 19D + 20)y = xe^{+x} + 2e^{-4x}\sin x$ [7]

6. Prove that the series $\sum_{n=0}^{\infty}(-1)^n \frac{x^2+n}{n^2}$ converges uniformly in every bounded interval but does not converge absolutely for any value of x. [7]

7. Test the convergence of the series : [7]

$$\sum_{n}(\sqrt{n+1}-\sqrt{n})$$

8. Find half range sine series for the function : [7]

$f(x) = x(\pi - x)$ for $0 \leq x \leq \pi$

9. Expand : [7]

$f(x) = x^2, \ -1 < x < 1$

in a Fourier series.

10. Determine Maclaurin's series expansion for the function $f(x) = (1+x)^m$, $(x > -1)$ [7]

Discuss if

(i) when m is a positive integer.

(ii) when m is not a positive integer.

11. Find the bilinear mapping that maps the points [7]

$z_1=\infty$, $z_2=i$, $z_3=0$ into the points $w=0$, $w_2=i$ & $w_3=\infty$ [7]

12. If $u - v = (x - y)(x^2 + 4xy + y^2)$, then determine the analytic function $w = u + iv$ and express w in terms of z. [7]

13. If $2\cos\alpha = x + \frac{1}{x}$, $2\cos\beta = y + \frac{1}{y}$, prove that one of the values of $x^m y^n + \frac{1}{x^m y^n}$ is $2\cos(m\alpha + n\beta)$ [7]

14. Using residue theorem, prove that : [7]

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

15. Find the value of $\oint_c \frac{e^z}{z^2+1}\,dz$, if c is a unit circle with centre at (i) z = i (ii) z = -i. [7]

----- x -----