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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 : Attempt any seven questions. All the questions carry equal marks. Use of calculator is permitted.

1. (a) State Abel's Test for uniform convergence of the series :

$$\sum_{n=1}^{\infty} u_n(x)v_n(x) \text{ in } (a, b). \quad [3]$$

- (b) Test the series $\sum \frac{(-1)^n}{n^p} \cdot \frac{x^{2n}}{1+x^2 \cdot n}$ for absolute and uniform convergence. [7]

2. Test the convergence of the series :

$$x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots, \quad x > 0 \quad [10]$$

3. Find a series of cosines of multiple of x to represent $x \sin x$ in the interval $(0, \pi)$. [10]

4. Find the Laurent's expansion of the function $\frac{e^z}{(z-1)^2}$ in the neighbourhood of its singularity. Hence, find its residue. [10]

5. Evaluate :

$$\int_0^\infty \frac{2}{1+2x^2 \cos \theta + x^4} dx \quad [10]$$

6. (a) Show that $\sin z$ is not bounded. [4]

(b) Expand $\sin z$ in a Taylor's series about the point

$$z = \frac{\pi}{2}. \quad [6]$$

7. Evaluate :

$$\int_c \frac{e^{-z}(3z^2 + z)}{z^2 - 1} dz,$$

where c is the circle $|z| = 2$ [10]

8. Solve the following IBVP :

$$u_{xx} = u_t \text{ for } 0 < x < \pi, t > 0$$

$$u_x(0, t) = u_x(\pi, t) = 0 \text{ for } t > 0$$

$$u(x, 0) = x^2 \text{ for } 0 < x < \pi \quad [10]$$

9. Solve the differential equation :

$$\frac{1}{y^3} \frac{dy}{dx} + \frac{1}{x} \cdot \frac{1}{y^2} = x^2 \sin x, \quad x, y > 0 \quad [10]$$

10. Determine the solution of the undamped (forced vibrations) system :

$$m \frac{d^2 u}{dt^2} + ku = F_0 \cos wt, \quad u(0) = 0, \quad \frac{dw}{dt} = 1, \quad t = 0, \text{ when}$$

$$w = \sqrt{\frac{k}{m}} \text{ and } m, k \text{ \& } F_0 \text{ are fixed constant.} \quad [10]$$

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