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**BICE-027**

# B.Tech. – VIEP – MECHANICAL ENGINEERING / B.Tech. CIVIL ENGINEERING (BTMEVI / BTCLEVI)

## Term-End Examination

00263 **June, 2018**

## BICE-027 : MATHEMATICS-III

*Time : 3 hours* *Maximum Marks : 70*

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

**1.** Find the Fourier transform of $e^{-ax^2}$, where $a > 0$. 7

**2.** Find the Fourier Cosine-Transform of 7

$$f(x) = \begin{cases} x & \text{for } 0 < x < \frac{1}{2} \\ 1 - x & \text{for } \frac{1}{2} < x < 1 \\ 0 & \text{for } x > 1 \end{cases}$$

3. Find the Fourier Sine-Transform of $e^{-|x|}$. Hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2}\, dx$. 7

4. Find the Fourier Series expansion for the function 7

$$f(x) = x \cos x, \quad -\pi < x < \pi$$

5. Find the Fourier half-range cosine series of the function 7

$$f(t) = \begin{cases} 2t & , \quad 0 < t < 1 \\ 2(2-t) & , \quad 1 < t < 2 \end{cases}$$

6. Obtain Fourier series of the function 5+2=7

$$f(x) = \begin{cases} x & , \quad -\pi < x < 0 \\ -x & , \quad 0 < x < \pi \end{cases}$$

and hence show that

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$$

7. Find the Fourier series representing

$$f(x) = x, \quad 0 < x < 2\pi$$ 7

8. Solve : 7

$$(x^2 - yz)\, p + (y^2 - zx)\, q = z^2 - xy$$

**9.** Solve

$$\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \, \partial y} = \sin x \cdot \cos 2y. \qquad 7$$

**10.** Solve $(D^2 - DD' - 2D'^2)\, y = (y - 1)\, e^x$. 7

**11.** Solve $(D - 3D' - 2)^2\, z = 2e^{2x} \sin(y + 3x)$. 7

**12.** Solve the following equation by the method of separation of variables 7

$$\frac{\partial^2 u}{\partial x \, \partial t} = e^{-t} \cos x$$

given that $u = 0$ when $t = 0$ and $\frac{\partial u}{\partial t} = 0$ when $x = 0$.

**13.** If a string of length $l$ is initially at rest in equilibrium position and each of its points is given the velocity 7

$$\left(\frac{\partial y}{\partial t}\right)_{t=0} = b \sin^3 \frac{\pi x}{l},$$ find the displacement $y(x, t)$.

**14.** Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary condition $u(x; 0) = 3 \sin n\pi x$, $u(0, t) = 0$, $u(l, t) = 0$, where $0 < x < l$. 7

**15.** Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ which satisfies the conditions $u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin \frac{n\pi x}{l}$ 7