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BICE-027

01995

B.Tech. IN MECHANICAL ENGINEERING / B.Tech. IN CIVIL ENGINEERING

Term-End Examination

June, 2012

BICE-027 : MATHEMATICS III

Time : 3 hours *Maximum Marks : 70*

Note : *All the questions are to be answered in English Language only. All the questions carry* ***equal*** *marks. Attempt* ***any seven*** *questions.*

1. Expand the function : **10**

$$f(x) = \frac{1}{4} - x \text{ , if } 0 < x < \frac{1}{2}$$

$$= x - \frac{3}{4} \text{ , if } \frac{1}{2} < x < 1$$

as the Fourier series of Sine terms.

2. Prove that for $0 < x < \pi$, **10**

$$x(\pi - x) = \frac{\pi^2}{6} - \left(\frac{\cos 2x}{1^2} + \frac{\cos 4x}{2^2} + \frac{\cos 6x}{3^2} + \ldots\ldots \right)$$

and deduce by Parseval's formula $\sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90}$

3. Find the inverse Fourier transform of $f(s) = e^{-|s|y}$, where $Y \epsilon [-\infty, \infty]$. **10**

4. Find $f(x)$ if its Cosine Transform is $\frac{1}{1+S^2}$ **10**

5. Solve : $\left(\frac{\partial^2}{\partial x^2} - \frac{\partial^2}{\partial x \partial y} + \frac{\partial}{\partial y} - 1\right) Z = \cos(x+2y) + e^y$. **10**

Where symbols have their usual meaning.

6. Obtain the solution of the wave equation **10**

$\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$. Using the method of separation of variables.

7. Find the solution of $\frac{\partial^2 u}{\partial x^2} = h^2 \frac{\partial u}{\partial t}$ for which **10**

$u(0, t) = u(l, t) = 0$ $u(x, 0) = \text{Sin}\left(\frac{\pi x}{l}\right)$ by method of variables separable.

8. Obtain the steady state temperature distribution in a rectangular metal plate of length 'a' and width 'b', the sides of which are kept at temperature 0°C. the lower edge is kept at 100°C and the upper edge kept insulated. **10**

9. Find the deflection $u(x, y, t)$ of the square membrane with $a = b = 1$, and $c = 1$, if the initial velocity is zero and the initial deflection is : **10**

$f(x, y) = A \sin(\pi x) . \sin(2xy)$.

10. Attempt *any two* questions : **5x2=10**

(a) Solve : $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = \cos mx \cos ny$.

Where symbols have their usual meaning.

(b) Solve : $Z(xp - yq) = y^2 - x^2$. Where p and q have their usual meaning.

(c) Solve : $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} + \frac{\partial z}{\partial x} - 2\frac{\partial z}{\partial y} = e^{x+y}$

Where symbols have their usual meaning.