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

Term-End Examination

December, 2013

BICE-027 : MATHEMATICS III

Time : 3 hours *Maximum Marks : 70*

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

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1. Find the Fourier series expansion of the following $2\pi -$ periodic function. **10**

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

2. Obtain the Fourier series expansion of $f(x) = 1 + x,\ -1 < x < 1,$ and hence show that: **10**

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ----.$$

3. Describe Fourier transform, Fourier sine transform and Forrier cosine transform with examples. **10**

4. State convolution theorem for Fourier transform and hence evaluate the inverse Fourier transform of : **10**

$$\frac{1}{12 + 7iw - w^2}$$

5. Find the complete integral of : **10**

$$2xz \frac{\partial z}{\partial x} + 2yz \frac{\partial z}{\partial y} = z^2 - x^2 - y^2$$

6. Find the general solution of : **10**

$$2 \frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} - \frac{\partial^2 z}{\partial y^2} + \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} = e^{2x+3y}$$

7. An elastic string of length l, which is fastened at its ends $x=0$ and $x=l$, is picked up at its centre point $x=\frac{l}{2}$ to a height of $\frac{l}{2}$ and is released from the rest. Find the displacement of the string at any instant of time. **10**

8. Discuss Fourier series solution of one dimensional heat equation. **10**

9. Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the temperature distribution in a rectangular plate subject to the following conditions : **10**

$u(0, y) = 0,\ u(a, y) = 0;\ u(x, 0) = f(x),\ u(x, b) = 0.$

10. (a) Obtain a second order partial differential equation from : **10**

$u = f(x + ct) + g(x - ct)$

where f and g are arbitrary functions and c is a constant.

(b) Solve the partial differential equation :

$$y \frac{\partial z}{\partial x} - x \frac{\partial z}{\partial y} = 0$$