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

Term-End Examination

December, 2012

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 a fourier series to represent $x - x^2$ from $x = -\pi$ to $x = \pi$. 7

2. Find the fourier series expansion for $f(x)$, if 7

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

Also deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ... = \frac{\pi^2}{8}$

3. For a function $f(x)$ defined by $f(x) = |x|$, $-\pi < x < \pi$, obtain a fourier series. 7

4. Find the half-range sine series for the function $f(t) = t - t^2$, in the interval $0 < t < 1$. 7

5. Solve $(x^2-yz)\ p+(y^2-zx)\ q=z^2-xy$. 7

6. Find the general solution of : 7

$$x\ (z^2-y^2)\ \frac{\partial z}{\partial x}+y\ (x^2-z^2)\ \frac{\partial z}{\partial y}=z\ (y^2-x^2).$$

7. Solve ; $\frac{\partial^3 z}{\partial x^3}-3\ \frac{\partial^3 z}{\partial x^2\ \partial y}+4\ \frac{\partial^3 z}{\partial y^3}=e^{x+2y}$ 7

8. Solve ; $\frac{\partial^2 z}{\partial x^2}-5\ \frac{\partial^2 z}{\partial x \partial y}+6\ \frac{\partial^2 z}{\partial y^2}=e^{x+y}$ 7

9. Solve ; $\cos\ (x+y)\ dy=dx$ 7

10. Solve ; $\cos x\ \frac{dy}{dx}=y\ \sin x+y^3\ \cos^2 x$ 7

11. Solve ; $\frac{d^2 y}{dx^2}-2\ \frac{dy}{dx}+y=x\ e^x \sin x$ 7

12. Solve ; $\left[1+e^{x/y}\right] dx+e^{x/y}\left[1-\frac{x}{y}\right] dy=0$ 7

13. Using the method of separation of variables, 7

Solve ; $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$

Where : $u(x, 0) = 6\, e^{-3x}$.

14. Obtain the solution of the wave equation. 7

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

15. The rate at which bacteria multiply is proportional to the instantaneous number present. If the original number doubles in 2 hours, in how many hours will it triple ? 7