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ET-102

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) B.Tech. (Aerospace Engineering)

01162

Term-End Examination

December, 2011

ET-102 : MATHEMATICS III

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any ten** questions. Use of scientific calculator is allowed.*

1. Test the convergence of the series : 7

$$\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+\cdots\infty$$

2. Test the convergence of the series : 7

$$1+\frac{2}{5}x+\frac{6}{9}x^2+\frac{14}{17}x^3+\cdots+\frac{2^n-2}{2^n+1}x^{n-1}+\cdots(x>0).$$

3. Express $f(x)=x$ as a Fourier series in the interval $-\pi < x < \pi$. 7

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

5. (a) Find the Laplace transforms of t cos at. 7

(b) Find the inverse transforms of :

$$\frac{4s + 5}{(s - 1)^2 (s + 2)}$$

6. Solve the following equation by Laplace transform method : 7

$y'' + y = t,\ y(0) = 1,\ y'(0) = -2.$

7. If $2\cos\theta = x + \frac{1}{x}$ and $2\cos\phi = y + \frac{1}{y}$, 7

Show that one of the values of

$$\frac{x^m}{y^n} + \frac{y^n}{x^m} \text{ is } 2\cos(m\theta - n\phi)$$

8. If $w = \phi + i\,\Psi$ represents the complex potential for 7

an electric field and $\Psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$,

determine the function ϕ.

9. Find the transformation which maps the points -1, i, 1 of the z - plane onto 1, i, -1 of the w - plane respectively. 7

10. Prove that 7

$$\int_C (z-a)^n dz = 0$$

(n, any integer $\neq -1$)

where C is the circle $|z - a| = r$.

11. Find the residue of 7

$$\frac{ze^z}{(z-1)^3}$$ at its pole.

12. Solve $\sec^2 y \frac{dy}{dx} + x \tan y = x^3$. 7

13. Solve $xp + yq = z$. 7

14. Solve 7

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

15. Use the method of separation of variables to solve the equation. 7

$$\frac{\partial^2 v}{\partial x^2} = \frac{\partial v}{\partial t}$$

Given that $v = 0$ when $t \to \infty$,

as well as $v = 0$, at $x = 0$, and $x = l$.
