Registration No. : | | | | | | | | | | |

*Total number of printed pages – 2*

B. Tech

BSCM 2101(Old)

## Special Examination – 2012

## MATHEMATICS – I

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2×10

   (a) What is the Laplace transform of the function $f(t) = t^2 \sin wt$.

   (b) Find Laplace transform of unit step function .

   (c) Find the radius of curvature of the curve $r = a + b\cos\theta$ at $\theta = \pi$.

   (d) Define asymptote of a curve.

   (e) What are Bessel's function and Bessel's equation ?

   (f) Show that $J_1^{1}(x) = J_0(x) - \frac{1}{x} J_1(x)$ .

   (g) Find the radius of convergence of the series $\sum_{m=0}^{\infty} \frac{1}{4^m}(x-5)^{2m}$

   (h) What is an integrating factor ?

   (i) Write the form of linear differential equation of second order with an example.

   (j) Is the differential equation $ydx - xdy = 0$ is exact, if not, find the integrating factor.

2. (a) Solve : $\frac{dy}{dx} = x^3y^2 + xy$ 5

   (b) Solve $(3x^2y^4 + 2xy)\,dx + (2x^3y^3 - x^2)\,dy = 0$. 5

P.T.O.

3. (a) Find the current in the simple circuit with $c = \infty$ and $E(t) = E_0 \sin wt$. 5

(b) Solve : $\frac{d^2y}{d^2x} - 4\frac{dy}{dx} + 4y = e^x \cos x$. 5

4. (a) Solve the differential equation $(1 - x^2)\, y^{11} - 2xy^1 + 2y = 0$, given that $y_1 = x$ is a solution. 5

(b) Using variation of parameter to solve the differential equation 5

$$\frac{d^2y}{d^2x} + 9y = \sec 3x.$$

5. (a) Find the radius of curvature of the curve $r^2 = a^2(1 - \cos^2\theta)$. 5

(b) Find the asymptotes of the curve $y^2 = \frac{x^2(a+x)}{a-x}$. 5

6. (a) Find the power series solution of $y^{11} + 8xy^1 - 4y = 0$. 5

(b) Show that : $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ 5

7. (a) Find the Laplace transform of $\frac{s+2}{s^2 + 4s + 4}$ 5

(b) Using convolution theorem, find the inverse Laplace transform of $\frac{s^2}{(s^2 + a^2)^2}$ 5



8. (a) Use the Laplace Transformation to solve the following initial value problem :

$y^{11} - 2y^1 - 3y = 0$, $y(0) = 1$, $y^1(0) = 7$ 5

(b) Find the Laplace transform of f(t) by expressing it in unit step function : 5

$$f(t) = \begin{cases} 2 & 0 < t < \pi \\ 0 & \pi < t < 2\pi \\ \sin t & t > 2\pi \end{cases}$$