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Total number of pr	rinted na	005-	2	 	1		B. Tech
Registration No.:							

Special Examination - 2012

MATHEMATICS - I

Full Marks - 70

Time: 3 Hours

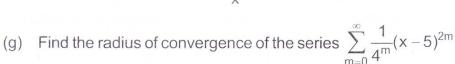
Answer Question No. 1 which is compulsory and any five from the rest. The figures in the right-hand margin indicate marks.

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



- (h) What is an integrating factor?
- (i) Write the form of linear differential equation of second order with an example.
- (i) 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
$$(3x^2y^4 + 2xy) dx + (2x^3y^3 - x^2) dy = 0$$
.

P.T.O.

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

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

- 4. (a) Solve the differential equation $(1 x^2) y^{11} 2xy^1 + 2y = 0$, given that $y_1 = x$ is a solution.
 - (b) Using variation of parameter to solve the differential equation $\frac{d^2y}{d^2x} + 9y = \sec 3x.$
- 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 $y^2 = \frac{x^2(a+x)}{a-x}$.
- 6. (a) Find the power series solution of $y^{11} + 8xy^1 4y = 0$.
 - (b) Show that : $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ 5
- 7. (a) Find the Laplace transform of $\frac{s+2}{s^2+4s+4}$
 - (b) Using convolution theorem, find the inverse Lablace transform of $\frac{s^2}{(s^2 + a^2)^2}$
- 8. (a) Use the Laplace Transformation to solve the following initial value problem:

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

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

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