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| ADAMAS UNIVERSITY<br>PURSUE EXCELLENCE | **ADAMAS UNIVERSITY**<br>**END-SEMESTER EXAMINATION : JANUARY 2021**<br>(Academic Session: 2020 – 21) | | |
| **Name of the Program:**<br>(Example: B. Sc./BBA/MA/B.Tech.) | B.Tech. (ECE/EE) | **Semester:**<br>(I/III/ V/ VII/IX) | III |
| **Paper Title :** | Engineering Mathematics III (Transform Calculus & Special Functions) | **Paper Code:** | SMA42109 |
| **Maximum Marks :** | 40 | **Time duration:** | 03 Hours |
| **Total No of questions:** | 08 | **Total No of Pages:** | 02 |
| *(Any other information for the student may be mentioned here)* | 1. At top sheet, clearly mention Name, Univ. Roll No., Enrolment No., Paper Name & Code, date of Exam.<br>2. All parts of a Question should be answered consecutively. Each Answer should start from a fresh page.<br>3. Assumptions made if any, should be stated clearly at the beginning of your answer.<br>4. Symbols have their usual meaning. | | |

***Answer all the Groups***

**Group A**

Answer all the questions of the following $5 \times 1 = 5$

1. a) The value of $\int_0^\infty \frac{\sin t}{t} dt$ is

(i) $\frac{\pi}{2}$ (ii) $\pi$ (iii) $\frac{\pi}{3}$ (iv) $\frac{\pi}{4}$

b) If $L^{-1}\{f(s)\} = F(t)$ then $L^{-1}\left\{\frac{d^n f(s)}{ds^n}\right\} =$

(i) $(-1)t^n F(t)$ (ii) $(-1)^n t^n F(t)$ (iii) $(-1)^{n+1} t^n F(t)$ (iv) None of these

c) The inverse Laplace transform of $\frac{s}{(s^2+4)^2}$ is

(i) $\frac{1}{2} t \sin 2t$ (ii) $\frac{1}{2} t \cos 2t$ (iii) $\frac{1}{4} t \cos 2t$ (iv) $\frac{1}{4} t \sin 2t$

d) The Z-transform of unit step sequence $u[n]$ is defined as $u[n] = \begin{cases} 1; & n \geq 0 \\ 0; & n < 0 \end{cases}$ is

(i) $\frac{1}{z-1}; |z| > 1$ (ii) $\frac{z}{z-1}; |z| < 1$ (iii) $\frac{z}{z-1}; |z| > 1$ (iv) $\frac{1}{z-1}; |z| < 1$

e) The value of Hermite polynomial $H_{2n}(0)$ is equal to

(i) $(-1)^{2n}$ (ii) $(-1)^{n-1}$ (iii) $(-1)^{n+1}$ (iv) 0

## GROUP –B

Answer *any three* of the following $3 \times 5 = 15$

2. Using Laplace transform technique to find the solution of the initial value problem $\frac{d^2y}{dx^2} + 9y = 9u(t-3);\ y(0) = y'(0) = 0$, where $u(t-3)$ is the unit step function. **[5]**

3. Formulate the initial value problem for current flow in an RLC circuit and hence find the steady-state charge and steady-state current series with $L = \frac{1}{2}H$, $R = 10\Omega,\ C = \frac{1}{100}F,\ \ E(t) = 120V,\ q(0) = 1.2C$ and $i(0) = 10A$. **[5]**

4. Use partial fraction method to evaluate the inverse Z-transform of $F(z) = \frac{3z^2 - z}{(z-1)(z-2)^2}$. **[5]**

5. Using Rodrigue's formula find value of $P_0(x), P_1(x), P_2(x)$, and $P_3(x)$. **[5]**

## GROUP –C

Answer *any two* of the following $2 \times 10 = 20$

6. A homogeneous string is stretched and fixed between two points $(0,0)$ and $(l,0)$. Motion is initiated by displacing the string in the form $u = \lambda \sin(\pi x / l)$ and released from rest at time $t = 0$. Find the displacement of any point on the string at any time $t$ by using Laplace transform technique. **[10]**

7. (a) Find the inverse Z-transform of $F(z) = \frac{z(3z^2 - 6z + 4)}{(z-1)^2(z-2)}$ by using Residues method.

   (b) Use Z-transform to solve the difference equation $y_{n+1} + y_n = 1$; given $y_0 = 0$. **[6+4]**

8. State and prove the orthogonality properties of Laguerre's polynomials. **[10]**

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