04-06-2026 SE IT SEM-III (NEP-2020) AMT-I QP CODE: 20008652

Duration:2 hrs **Marks:60**

NB: (1) Question **no 1** is **compulsory**.
(2) Attempt any **three** questions out of the remaining **five**.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if required and state it clearly.

Q1. Attempt **any five** questions

(a) Find Laplace Transform of $f(t) = e^{4t}\text{t}\sin(5t)$ **[3]**

(b) Find $L^{-1}\left\{\frac{1}{s\,(s^2+9)}\right\}$. **[3]**

(c) Obtain Fourier Expansion $for f(x) = x$ in the interval $(-\pi, \pi)$. **[3]**

(d) Show that $u = x^2 - y^2 + 2x$ is a harmonic function. **[3]**

(e) Give two regression lines $4X - 5Y + 33 = 0\ and\ 20X - 9Y - 107 = 0$,find correlation coefficient (r). **[3]**

(f) Find E(X), when X has the following probability distribution **[3]**

x	-3	6	9
P(X=x)	1/6	1/2	1/3

Q2. (a) Evaluate $\int_0^{\infty} \frac{\sin(t)}{t}\,dt$using Laplace Transform. **[4]**

(b) Find $L^{-1}\left\{\frac{2s^2-6s+5}{s^3-6s^2+11s-6}\right\}$. **[5]**

(c) Construct analytic function, whose imaginary part is $tan^{-1}(y/x)$. **[6]**

Q3. (a) Find Inverse Laplace Transform of $F(s) = \frac{s+3}{s^2+4s+5}$. **[4]**

(b) Find Laplace Transform of $f(t) = t\,cos(\omega t - \alpha)$, where $\omega\ and \alpha$ are constants. **[5]**

(c)Find moment generating function of the following distribution. Hence find mean and variance. **[6]**

X	1	3	4	5
P(X)	0.4	0.1	0.2	0.3

Q4. (a) It is given that u= $e^x \cos y$is harmonic function, find its harmonic conjugate. **[4]**

(b) obtain half-range cosine series for $f(x) = x(2-x)\ in\ 0 \le x \le 2$. **[5]**

(c)Find$L\left\{t\int_0^t e^u \sin u\,du\right\}$. **[6]**

Q5. (a) Let X be continuous random variable with probability density function $f(x) = \frac{1}{2}x^2e^{-x}, where\ x > 0$. Find its mean and Variance. **[4]**

(b)Fit a straight line of the form $y = a + bx$ to the following data **[5]**

x	1	2	3	4	5
y	2	7	9	10	11

(c) Use Convolution theorem to find the Inverse Laplace Transform of $F(s) = \frac{1}{(s-1)(s^2+4)}$. **[6]**

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Q6. (a) From the following data calculate Spearman's rank correlation coefficient R between X and Y **[4]**

X	61	63	65	67	69
Y	64	62	66	70	72

(b) If $f(z) = (ax^2 + axy + by^2) + i(cx^2 + dxy + y^2)$is analytic function then what is the value of a,b,c,d. **[5]**

(c)Expand Fourier series for$f(x) = \left(\frac{\pi - x}{2}\right)^2 in\ (0, 2\pi)$. **[6]**

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