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B. Tech. III Sem. (Main) Exam., Dec. - 2019

Common for EE/EEE

3EE2-01 Advance Mathematics

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 ×2 marks = 20 marks. All ten questions are compulsory.*

Part – B: *Analytical/Problem Solving questions 5 ×8 marks = 40 marks. Candidates have to answer five questions out of eight.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 ×15 marks = 60 marks. Candidates have to answer four questions out of five.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART - A

Q.1 Prove that

$$\Delta \log f(x) = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$$

Q.2 Prove that $E = e^{hD}$, where D is the differential operator of differentiation $\left(D \cong \frac{d}{dx}\right)$

Q.3 State Simpson's one third rule.

Q.4 Find the Laplace transform of $\sin^2 3t$.

Q.5 Find the inverse Laplace transform of $\frac{6s-4}{s^2-4s+20}$

Q.6 Find the Fourier cosine transform of the function

$$f(x) = \begin{cases} \cos x & 0 < x < a \\ 0 & x > a \end{cases}$$

Q.7 Find z - transform of $u_n = na^n$, $n \geq 0$

Q.8 Find the inverse z - transform of $\frac{z}{z-a}$, $|z| > a$

Q.9 Prove that $u = y^3 - 3x^2y$ is a harmonic function. Determine its harmonic conjugate.

Q.10 Define Mobius transformation

PART - B

Q.1 Use the method of separation of symbols to prove if $y = u_x$ and $0 < x < 1$

$$u_0 + \frac{u_1 x}{\lfloor 1} + \frac{u_2 x^2}{\lfloor 2} + \ldots\ldots = e^x\left[u_0 + x\Delta u_0 + \frac{x^2}{\lfloor 2}\Delta^2 u_0 + \ldots\ldots\right]$$

Q.2 Find the value of f(5) from the following table by using Lagrange's interpolation formula.

x	1	2	3	4	7
f(x)	2	4	8	16	128

Q.3 Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}$ rule. Hence obtain the approximate value of π.

Q.4 Find the real root of the equation $x^3 - 3x - 5 = 0$ correct to four places of decimals by Newton Raphson (N-R) method.

Q.5 Find the Laplace transform of $\sin\sqrt{t}$.

Q.6 If $L^{-1}\left[\frac{s}{(s^2+1)^2}\right] = \frac{t}{2}\sin t$

Show that $L^{-1}\left[\frac{1}{(s^2+1)^2}\right] = \frac{1}{2}(\sin t - t\cos t)$

Q.7 Find the bilinear transformation which transforms the point $z = 2, 1, 0$ into $w = 1, 0, 1$

Q.8 If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$. Find the corresponding analytic function $f(z) = u + iv$

PART – C

Q.1 Use stirling's formula to find Y_{28} given –

$Y_{20} = 49225$, $Y_{25} = 48316$, $Y_{30} = 47236$, $Y_{35} = 45926$, $Y_{40} = 44306$

Q.2 Find the root of the equation $x^3 - 9x + 1 = 0$ between $x = 2$ and $x = 4$ by the method of bisection

Q.3 Find f(x) if its Fourier sine transform is $\frac{s}{1+s^2}$

Q.4 Find the inverse z – transform of

$$F(z) = \frac{z^2}{\left(z-\frac{1}{4}\right)\left(z-\frac{1}{5}\right)}$$

(I) $\frac{1}{5} < |z| < \frac{1}{4}$

(II) $|z| < \frac{1}{5}$

Q.5 Show that the function $f(z) = \sqrt{(|xy|)}$ is not analytic at the origin, although Cauchy - Riemann equations are satisfied at the point.

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