3E1206

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B.Tech. III Sem. (Main) Examination, April/May - 2022
Automobile Engineering
3AE2-01 Advance Engineering Mathematics-I
AN, AG, AE, CE, CR, EC, EI, ME, MH, PT

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

Attempt all ten questions From Part A, All five Questions from Part B and three questions out of five questions from Part C .

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

Use of following supporting material is permitted during examination (As mentioned in form No.205)

PART - A

(Word limit 25)

(10×2=20)

1. Evaluate, $\Delta^6 (ax-1)(bx^2-1)(cx^3-1)$

2. Prove that, $\left(\dfrac{\Delta^2}{E}\right)x^3 = 6x$ (if $h=1$)

3. Using Newton-Raphson's method, find the root of $x^4 - 12x + 7 = 0$ which is near to $x=2$.

4. Find the z-transform of unit impulse function which is given by $\delta_n = \begin{cases} 1 & if \ n=0 \\ 0 & if \ n\neq 0 \end{cases}$

5. Find inverse Z Transform of $\dfrac{5z}{(2-z)(3z-1)}$.

6. Find the Laplace transform of $f(t) = \begin{cases} \sin t & 0<t<\pi \\ 0 & t>\pi \end{cases}$.

7. Find inverse Laplace transform of $\dfrac{s+2}{(s-2)^3}$

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8. Write the Formulae of Fourier complex transform Fourier cosine transform and their inverse also.

9. Write the formulae of Simpson 1/3 rule and Simpson 3/8 rule.

10. By using Picard's method, solve the equation $\frac{dy}{dx} = y - x$ with $x = 0$, $y = 2$ upto third order of approximation.

PART - B
(Word limit 100)

1. From the following table find the number of students who obtained   (5×4=20)
   a) Less than 45 marks.
   b) More than 45 marks.

Marks obtained:	30-40	40-50	50-60	60-70	70-80
No's of students:	31	42	51	35	31

2. Find the approximate value correct to three places of decimal of the real root of the equation $x^3 - 3x + 4 = 0$, using method of false position three times in succession.

3. Find the Fourier Sine and Cosine transform of $f(x) = \begin{bmatrix} x & for & 0 < x \le 1 \\ 2-x & for & 1 < x < 2 \\ 0 & for & x \ge 2 \end{bmatrix}$

4. If $\bar{u}(z) = \frac{2z^2 + 5z + 14}{(z-1)^4}$ for the sequence $\{u_n\}, n \ge 0$ Evaluate u_2 and u_3.

5. Find Inverse Laplace transform of $\frac{S}{S^4 + 4a^4}$ ersahilkagyan.com

PART - C
(Any Three)   (3×10=30)

1. Solve $(D^2 + 9)y = \cos 2t$, given that $y(0) = 1$. $y(\pi/2) = -1$.

2. Obtain Fourier transform of $f(x) = \begin{cases} x^2 & for & |x| \le a \\ 0 & for & |x| > a \end{cases}$

   Hence evaluate $\int_0^\infty \cos\left(\frac{as}{2}\right) \left[\frac{(a^2s^2 - 2)\sin as + 2as\cos as}{s^3} \right] ds$

3. Solve by z transform of $u_{n+2} - 6u_{n+1} + 8u_n = 2^n + 6n$.

4. Using Milne's Predictor-Corrector Method, obtain the value of y for $x=0.4$ for the following equation $\frac{dy}{dx} = 2e^x - y$, given that

x:	0	0.1	0.2	0.3
y:	2	2.01	2.04	2.09

5. A slider in a machine moves along a fixed straight rod. Its distance x(cm) along the rod is given below for various values of time t(sec)

$t \Rightarrow$	0	0.1	0.2	0.3	0.4	0.5	0.6
$x \Rightarrow$	30.28	31.43	32.98	33.54	33.97	33.48	32.13

Evaluate

i) Velocity for $t = 0.1, 0.5$ and 0.3

ii) Acceleration for $t = .02, .33$ and $.58$