1T00833 - S.E.(Electiral Engineering)(SEM-III)(Choice Base Credit Grading System) (R- 19) ('C' Scheme) / 51021 - Engineering Mathematics - III

CODE: 10012758   DATE: 21/11/2022

Duration: 3 hours   **Max. Marks: 80**

N.B. (1) Question No. 1 is **COMPULSORY**.

   (2) Answer **ANY THREE** questions from Q.2 to Q.6.

   (3) Use of Statistical Tables permitted.

   (4) Figures to right indicate full marks.

Que. 1   a.   Find Laplace Transform of $sinh3t.sin3t.cos5t$ 5

     b.   Find Fourier series expansion of $f(x) = x^2$ in $(-\pi, \pi)$ 5

     c.   Find a , b ,c , d if f(z)=$(x^2 + axy + by^2) + i(cx^2 + dxy + y^2)$ is an   5
analytic function.

     d.   If A=$\begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$ find eigenvalues of A^2 -2A+I & eigen values of adjA   5

Que. 2   a.   Obtain Fourier series expansion for f (x) = x | x| in (-1, 1)   6

     b.   By using convolution theorem, find the inverse Laplace transform of   6
$\dfrac{s}{(s^2+9)(s^2+16)}$

          Find the eigenvalues and the eigenvectors of the matrix   8

     c.   A=$\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

Que. 3   a.   Find the analytic function whose real part is $u = e^{2x}(x\cos 2y - y\sin 2y)$ 6

     b.   Find the Laplace transform of $sin^5 t$ 6

          By using Green theorem, evaluate $\oint_C \overline{F}.\overline{dr}$ where C is the curve enclosing   8
     c.   the region bounded by $y^2 = 4ax$, x=a in xy plane and
               $\overline{F} = (2x^2y + 3z^2)i + (x^2 + 4yz)j + (2y^2 + 6xy)$

Que. 4
     a.   Verify Cayley-Hamilton theorem for A=$\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence find A^{-1} 6

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b. Find the harmonic conjugate of the function $v = 3x^2y + 6xy - y^3$ and the corresponding analytic function $f(z) = u + iv$ in terms of z   6

c. Obtain the half range cosine series of $f(x) = \pi x - x^2$ in $(0, \pi)$, hence   8

deduce that $\sum\limits_{n=1}^{\infty} \dfrac{1}{n^4} = \dfrac{\pi^4}{90}$

Que. 5
a. Find the analytic function $f(z) = u + iv$, in terms of z, if   6

$$u + v = \frac{2 \sin 2x}{e^{2y} + e^{-2y} - 2 \cos 2x}$$

b. Show that $\bar{F} = (y^2\cos x + z^3)i + (2y\sin x - 4)j + (3xz^2 + 2)k$ is conservative. Find its corresponding scalar potential Ø.   6

c. Find inverse Laplace transform of the following functions   8

  i. $tan^{-1}\left(\frac{s}{2}\right)$ ii. $\dfrac{e^{-3s}}{s^2 - 4s + 5}$

Que. 6
a. By using stokes theorem, evaluate $\oint_C \bar{F}.\overline{dr}$ where $\bar{F} = x^2i + xyj$ where 'C' is the boundary of the rectangle x=0, y=0, x=a, y=b   6

b. By using Laplace transform, evaluate, $\int_0^{\infty} \frac{\cos 2t - \cos 3t}{t} dt$ 6

c. Determine if the matrix A= $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ diagonalizable, hence find   8

it's diagonal matrix D and modal matrix