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SVKM's NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B. Tech (IT/COMPUTER/ MECHANICAL/ MECHATRONICS/CIVIL/EXTC/ELECTRICAL) Year: II Semester: III

Academic Year: 2019-20

Subject: Engineering Mathematics – III

Date: 05 November 2019

Marks: 70
Time: 2.00 pm - 5.00 pm
Durations: 3 (hrs)
No. of Pages: 2

Re-Examination (2016-17/ 2017-18)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

1) Question No. _1___ is compulsory.
2) Out of remaining questions, attempt any __4___ questions.
3) **In all ___5_ questions to be attempted.**
4) All questions carry equal marks.
5) **Answer to each new question to be started on a fresh page.**
6) **Figures in brackets on the right hand side indicate full marks.**
7) **Assume suitable data if necessary.**

Q1)

a) Find the Laplace transform of f(t), $f(t)=\begin{cases}(t-2)^2 & t>2\\ 0 & 0<t\le 2\end{cases}$ (4)

b) If A= $\begin{bmatrix}1 & 2 & -3\\ 0 & 3 & 2\\ 0 & 0 & -2\end{bmatrix}$ then calculate the eigen value of $3A^3+5A^2-6A+2I$ (4)

c) Obtain the Fourier series for $f(x)=x$ in the interval $(0,2\pi)$ (3)

d) Evaluate $L^{-1}\left[\dfrac{2s+2}{s^2+2s+10}\right]$ (3)

Q2) a) Verify Cayley-Hamilton theorem and use to find matrix represented by (5)

$A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+I$ .where $A=\begin{bmatrix}2 & 1 & 1\\ 0 & 1 & 0\\ 1 & 1 & 2\end{bmatrix}$.

b) Obtain A^{50}, where $A=\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$. (5)

c) Check whether $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ is diagonalizable , If yes then find the transforming matrix P and the diagonal matrix D. (4)

Q3) a) If f (t) is periodic with period 2a then find the Laplace transform of (5)

$$f(t)=\begin{cases} \frac{t}{a} & 0<t<a \\ \frac{1}{a}(2a-t) & a \le t < 2a \end{cases}$$

b)Obtain $L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4^2)}\right]$. (5)

c) Evaluate $\int_0^\infty e^{-\sqrt{2}t}\left[\frac{\sin t \sinh t}{t}\right]dt$. (4)

Q4) a)Solve $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+8y=1$, given that $y(0)=0, y'(0)=1$. (5)

b)Use Convolution to find the inverse of $\frac{(s+2)^2}{(s^2+4s+8)^2}$. (5)

c)Evaluate $L\{t^4 H(t-2)+t^2\delta(t-2)\}$. (4)

Q5) a) Express $\begin{aligned} f(x) &= 2 \quad -2<x<0 \\ &= x \quad 0<x<2 \end{aligned}$ in the form of Fourier series. (5)

b) Evaluate $\left\{\int_0^\infty e^{-2t}\left(\frac{\sinh t}{t}\right)dt\right\}$. (5)

c) Find the inverse Laplace transform of $\left[\frac{e^{-\pi s}}{s^2(s^2+1)}\right]$. (4)

Q6) a) Obtain half range sine series for $f(x) = e^x \ , \ 0 < x < 1$ (5)

b) Find the Fourier series expansion of $f(x) = |x|$ in the interval (-2,2) (5)

c) Show that the set of functions $\cos nx$ is orthogonal on $(0,2\pi)$.Write the orthonormal set. (4)

Q7) a) Using Fourier series for $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $0 < x < 2\pi$. (7)

Prove that $\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\ldots$

b) Reduce the quadratic form $6x_1^2+3x_2^2+3x_3^2-4x_1x_2+4x_3x_1-2x_2x_3$ to canonical form through orthogonal transformations. (7)