Roll No. [| | | | | | |]

TMA–101

B. Tech. (First Semester)
Mid Semester EXAMINATION, 2017

(All Branches)

ENGINEERING MATHEMATICS—I

Time : 1:30 Hours] [*Maximum Marks : 50*

Note : (i) This question paper contains two Sections.

(ii) Both Sections are compulsory.

Section—A

1. Fill in the blanks/True-False : (1×5=5 Marks)

(a) A matrix is said to be Unitary Matrix if ....

(b) The rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ is ....

(c) State true of false :

The characteristic roots of a skew Hermitian matrix are all real.

(d) If $x = u + v, y = u - v$, then $\frac{\partial u}{\partial x} =$ ....

(e) The Leibnitz theorem for the nth derivative is true, if n is .... number.

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2. Attempt any *five* parts : (3×5=15 Marks)

(a) Show that the system of equations :

$$x+y+z=-3$$
$$3x+y-2z=-2$$
$$2x+4y+7z=7$$

is not consistent.

(b) Define linearly dependence and linearly independent system of vectors.

(c) If $u=\tan^{-1}=\frac{x^3+y^3}{x-y}$, prove that :

$$x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$$

(d) Find y_n, if $y=\cos^3 x$.

(e) Find characteristic equation of :

$$A=\begin{bmatrix}1 & 2 & -1\\ 0 & 1 & -1\\ 3 & -1 & 1\end{bmatrix}$$

(f) Find first order partial derivatives of $u=\log(x^2+y^2)$.

Section—B

3. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

(a) Find Rank by reducing it to normal form :

$$\begin{bmatrix}0 & 1 & 2 & -2\\ 4 & 0 & 2 & 6\\ 2 & 1 & 3 & 1\end{bmatrix}$$

(b) Find the eigen values for the matrix :

$$A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$$

(c) Verify Cayley-Hamilton theorem for :

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

4. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

(a) If $y=\sin(m\sin^{-1}x)$, then prove that :

$$(1-x^2)\,y_{n+2}=(2n+1)\,xy_{n+1}+(n^2-m^2)\,y_n$$

(b) Expand $e^x\cos y$ in powers of x and y as far the terms of second degree using Taylor's theorem.

(c) If $u=e^{xyz}$, find the value of $\frac{\partial^3 u}{\partial x\partial y\partial z}$.

5. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

(a) Find the eigen vectors corresponding to the eigen value $\lambda=5$ for the matrix :

$$A=\begin{bmatrix}3 & 1 & 4\\ 0 & 2 & 6\\ 0 & 0 & 5\end{bmatrix}$$

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(b) Find nth derivative of $\frac{1}{x^2 - a^2}$.

(c) If $u = \log \frac{x^4 - y^4}{x - y}$, prove that :

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -3.$$