Code: 103202

B.Tech 2nd Semester Exam., 2021

(New Course)

MATHEMATICS—II

(Linear Algebra, Transform Calculus and Numerical Methods)

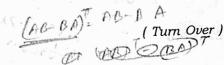
Time: 3 hours

Full Marks: 70

(e) Find the mission values to the: anothering

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **MNE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.
 - **1.** Answer any seven of the following: $2 \times 7 = 14$
 - (a) The eigenvalues of a matrix A are 2, 3, 1, then find the eigenvalues of $A^{-1} + A^2$.
 - (b) If A and B are symmetric matrices, then prove that AB BA is a skew-symmetric matrix.

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(c) Prove that the matrix
$$\begin{array}{c|ccccc}
 & 1 & 2 & 1 & 2 \\
 & 2 & 2 & 1 & 2 \\
 & 3 & 2 & 2 & 1 \\
 & 1 & -2 & 2 & 2
\end{array}$$
is orthogonal.

(h) Find the Laplace transforms of

(0), \$1 SP- = (0), (0)

 $te^{-t}\sin 2t$.

(d) Prove that $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + (\delta^2/4)}$.

Use Euler's method to obtain an approximate value of
$$y(0.4)$$
 for the equation $y'=x+y$, $y(0)=1$ with

(i) no solution, (ii) unique solution and x+2y+3z=10, $x+2y+\lambda z=\mu$ have

(iii) infinite solutions.

 $h=0\cdot 1.$

(g) Obtain the approximate value of
$$y(1\cdot 2)$$
 for the initial value problem $y' = -2xy^2$, $y(1) = 1$ using Taylor series second-order method with step size

(y) Obtain the approximate value of
$$y(1\cdot 2)$$
 for the initial value problem $y' = -2xy^2$, $y(1) = 1$ using Taylor series second-order method with step size

(i) Find the inverse Laplace transforms
of
$$\begin{array}{c}
1 \\
1 \\
1 \\
1
\end{array}$$
(i) Evaluate:
$$\begin{array}{c}
3 \\
5^4 - a^4
\end{array}$$
(g. 3)
$$\begin{array}{c}
1 \\
1 \\
1 \\
2
\end{array}$$

(a)

(g) Obtain the approximate value of
$$y(1\cdot 2)$$
 for the initial value problem $y' = -2xy^2$, $y(1) = 1$ using Taylor series second-order method with step size

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(b) Find the rank of the matrix
$$|\cdot, \rangle \lambda^0$$

$$\begin{bmatrix} 3 & 2 & -1 \\ 4 & 2 & 6 \end{bmatrix} \qquad \beta(t) - 4(-1)$$

1.2%

(Continued)

$$A = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$
Hence compute A^{-1} .

$$P = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 2 & 1 \end{bmatrix}$$
Addingtonal form

to diagonal form.

4. (a) Find a real root of the equation
$$x \log_{10} x = 1.2$$
 by Regula-Falsi method, correct to four decimal places.

$$L^{-1}\left\{\frac{1}{(s^2+4)(s+2)}\right\}$$
(b) Use Laplace Transform to solve:
$$\frac{dx}{dt} + y = \sin t, \quad \frac{dy}{dt} + x = \cos t$$

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5. (a) Find

 $\int_0^6 \frac{e^x}{1+x} dx$

(b)

Evaluate

 $\int_0^8 x \sec x \, dx$

(Turn Over.)

given that x=2, y=0 at t=0.

Find the Fourier transform of f(x), defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$

and hence evaluate
$$\int_{-\infty}^{\infty} \frac{\sin as \cos sx}{s} ds$$
(b) Evaluate:
$$\int_{0}^{\infty} e^{-st} t^{3} \sin t dt$$

10

*(*6) Solve the initial value problem yy' = x, Given the initial value problem: solution at x = 0.8. Extrapolate the Compare the results with the exact $0 \le x \le 0.8$, with h = 0.2 and h = 0.1. y(0) = 1, using the Euler method in

$$\frac{dy}{dx} = \frac{y - x}{y + x}, \ y(0) = 1$$
Find y(1) by Runge-Kutta fourth-order method taking $h = 0.5$.

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(Continued)

9. Obtain the approximate value of
$$y(0\cdot 2)$$
 for the initial value problem $y'=x^2+y^2$, $y(0)=1$. Using the methods $y_{n+1}=y_n+hf(x_n,y_n)$, as predictor and $y_{n+1}=y_n+\frac{h}{2}[f(x_n,y_n)+f(x_{n+1},y_{n+1})]$, as corrector, with $h=0\cdot 1$. Perform two

corrector iterations per step.