

Roll No: \_\_\_\_\_

**MCA-INT**  
**(SEM I) THEORY EXAMINATION 2021-22**  
**MATHEMATICS FOR MCA**

**Time: 3 Hours**

**Total Marks: 70**

**Notes:**

- Attempt all Sections and Assume any missing data.
- Appropriate marks are allotted to each question, answer accordingly.

**SECTION-A** Attempt All of the following Questions in brief

**Marks (7X2=14)**

|       |                                                                                                                                     |
|-------|-------------------------------------------------------------------------------------------------------------------------------------|
| Q1(a) | Evaluate: $\begin{vmatrix} 2 & -1 & 5 \\ 6 & -3 & 4 \\ -8 & 2 & 1 \end{vmatrix}$                                                    |
| Q1(b) | Find the value of $\lambda$ for which the vectors $(1, -2, \lambda)$ , $(2, -1, 5)$ and $(3, -5, 7\lambda)$ are linearly dependent. |
| Q1(c) | If $y = A \sin nx + B \cos nx$ , prove that $\frac{d^2y}{dx^2} + n^2y = 0$ .                                                        |
| Q1(d) | Find the P.I. of $(D^2 + 4)y = \cos 2x$ .                                                                                           |
| Q1(e) | Classify the P. D. E. $4u_{xx} - 3u_{xy} + 2u_{yy} - 7u_x + u_y = 0$ .                                                              |
| Q1(f) | Find the Laplace Transform of $\frac{\sin at}{t}$ . Does the Laplace Transform of $\frac{\cos at}{t}$ exists?                       |
| Q1(g) | State Convolution Theorem.                                                                                                          |

**SECTION-B** Attempt ANY THREE of the following Questions

**Marks (3X7=21)**

|       |                                                                                                                                                                                                                         |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Q2(a) | Find the inverse of the matrix M by applying elementary transformations<br>$M = \begin{bmatrix} 0 & 2 & 1 & 3 \\ 1 & 1 & -1 & -2 \\ 1 & 2 & 0 & 1 \\ -1 & 1 & 2 & 6 \end{bmatrix}$                                      |
| Q2(b) | (i) State and prove Euler's Theorem on homogeneous function.<br>(ii) If $u = f(y - z, z - x, x - y)$ , prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ . |
| Q2(c) | Solve: $\frac{dx}{dt} = 3x + 8y$ , $\frac{dy}{dt} = -x - 3y$ with $x(0) = 6$ , $y(0) = -2$ .                                                                                                                            |
| Q2(d) | Draw the graph and find the Laplace transform of the triangular wave function of period $2c$ given by $f(t) = \begin{cases} t, & 0 < t \leq c \\ 2c - t, & c < t < 2c \end{cases}$                                      |
| Q2(e) | Using Laplace transformation, solve the differential equation $\frac{d^2x}{dt^2} + 9x = \cos 2t$ , if $x(0) = 1$ , $x\left(\frac{\pi}{2}\right) = -1$ .                                                                 |

**SECTION-C** Attempt ANY ONE following Question

**Marks (1X7=7)**

|       |                                                                                                                                                                                                                      |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Q3(a) | Investigate, for what values of $\lambda$ and $\mu$ do the system of equations $x + y + z = 6$ , $x + 2y + 3z = 10$ , $x + 2y + \lambda z = \mu$ have (i) no solution (ii) unique solution (iii) infinite solutions? |
| Q3(b) | Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ .                                                                                  |

**SECTION-C** Attempt ANY ONE following Question

**Marks (1X7=7)**

|       |                                                                                                                                                                             |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Q4(a) | If $y = e^{m \cos^{-1} x}$ , show that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$ .                                                                         |
| Q4(b) | If $y_1 = \frac{x_2 x_3}{x_1}$ , $y_2 = \frac{x_1 x_3}{x_2}$ , $y_3 = \frac{x_1 x_2}{x_3}$ , then show that $\frac{\partial(y_1, y_2, y_3)}{\partial(x_1, x_2, x_3)} = 4$ . |



PAPER ID-411356

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SECTION-C Attempt ANY ONE following Question

Marks (1X7=7)

Q5(a) Solve:  $(D^2 - 1)y = 2x^4 - 3x + 1$ .Q5(b) Solve:  $r - 2s = \sin x \cdot \cos 2y$ 

SECTION-C Attempt ANY ONE following Question

Marks (1X7=7)

Q6(a) Find the Laplace Transform of the function  $F(t) = \begin{cases} 1, & 0 \leq t < 1 \\ t, & 1 \leq t < 2 \\ t^2, & 2 \leq t < \infty \end{cases}$

Q6(b) Express the function  $F(t) = \begin{cases} t-1 & 1 < t < 2 \\ 3-t & 2 < t < 3 \end{cases}$  in terms of unit step function and obtain its Laplace transformation.

SECTION-C Attempt ANY ONE following Question

Marks (1X7=7)

Q7(a) Find the inverse Laplace transform of function  $\frac{14p+10}{49p^2+28p+13}$ .

Q7(b) Use convolution theorem to evaluate  $L^{-1}\left(\frac{p}{(p^2+4)^2}\right)$ .

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