Subject Code: RAS107

PAPER ID-411356

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 λ 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 $(D^2+4)y = cos2x$.
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 $\frac{sinat}{t}$. Does the Laplace Transform of $\frac{cosat}{t}$ 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 $$M = \begin{bmatrix} 0 & 2 & 1 & 3 \\ 1 & 1 & -1 & -2 \\ 1 & 2 & 0 & 1 \\ -1 & 1 & 2 & 6 \end{bmatrix}$$
Q2(b)	(i) State and prove Euler's Theorem on homogeneous function. 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 $f(t) = \begin{cases} t, & 0 < t \le c \\ 2c - t, & c < t < 2c \end{cases}$
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 λ *and* μ 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 $y_1 = \frac{x_2x_3}{x_1}$, $y_2 = \frac{x_1x_3}{x_2}$, $y_3 = \frac{x_1x_2}{x_3}$, then show that $\frac{\partial(y_1, y_2, y_3)}{\partial(x_1, x_2, x_3)} = 4$.

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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: $r - 2s = sinx.\cos 2y$

SECTION-C Attempt **ANY ONE** following Question **Marks (1X7=7)**

Q6(a)	Find the Laplace Transform of the function $F(t) = \begin{cases} 1, & 0 \le t < 1 \\ t & 1 \le t < 2 \\ t^2 & 2 \le t < \infty \end{cases}$.
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 $L^{-1}\left(\frac{p}{(p^2+4)^2}\right)$.