

MATHEMATICAL PHYSICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The Cauchy-Riemann equations are used to test whether a function is a. periodic b. analytic c. harmonic only d. singular	K1	CO1
	2	A function that is analytic at all points of the z - plane and finite at infinity a. must have a singularity b. Must be zero c. must be constant d. cannot exist	K2	CO1
2	3	The Fourier sine transform of the function $f(x) = e^{-ax}$ is a. $\frac{s}{a^2+s^2}$ b. $\frac{a}{a^2+s^2}$ c. $\frac{s \sin ax}{a^2+s^2}$ d. $\frac{a \sin ax}{a^2+s^2}$	K1	CO2
	4	The Laplace transform of $t^2 e^{-at}$ a. $\frac{2}{s+a}$ b. $\frac{2}{(s+e)^2}$ c. $\frac{2}{(s+a)^2}$ d. $\frac{2}{(s+e)^4}$	K2	CO2
3	5	The Legendre differential equation has singular points a. $(0, \infty)$ b. $(-\infty, \infty)$ c. $(-1, 1)$ d. none of these	K1	CO3
	6	The modified Bessel's function $J_n(x)$ and $K_n(x)$ are a. Oscillatory in nature b. Exponential in nature c. Linear in nature d. Constant in nature	K2	CO3
4	7	In heat flow equation $\nabla^2 u = \frac{1}{h^2} \frac{\partial u}{\partial t}$, the quantity h is called a. Speed of light b. Resistivity c. Diffusivity d. Heat flow constant	K1	CO4
	8	D' Alembert solution of one dimensional vibrating string a. $f(x - ct)$ b. $f(x + ct)$ c. $f_1(x - ct) + f_2(x + ct)$ d. $f_1(x - ct) \times f_2(x + ct)$	K2	CO4
5	9	Runge kutta formula for solving the differential equation involves an error of a. second order b. third order c. fourth order d. fifth order	K1	CO5
	10	The cube root of 12 by Newton - Raphson method upto three decimal places is a. 2.302 b. 2.289 c. 2.278 d. 2.928	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO										
1	11.a.	Identify the analytic function, whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$	K1	CO1										
	(OR)													
	11.b.	Write the Laurent's series, expansion of the function $f(z) = \frac{1}{(1-z)(2-z)}$, valid for $0 < z - 1 < 1$												
2	12.a.	Give the Fourier sine transform of $\frac{e^{-ax}}{x}$.	K2	CO2										
	(OR)													
	12.b.	Give the Laplace transform of $f(t) = t^2 e^t \sin 4t$												
3	13.a.	Solve the differential equation $\frac{dy}{dx} + \frac{y}{x} = \frac{y^2}{x^2}$	K2	CO3										
	(OR)													
	13.b.	Derive the recurrence formulae for $x \cdot J'_n(x) = n J_n(x) - x J_{n+1}(x)$												
4	14.a.	Solve the differential equation $2x \frac{\partial u}{\partial x} - 3y \frac{\partial u}{\partial y} = 0$ by the method of separation of variables	K2	CO4										
	(OR)													
	14.b.	Give the equation for linear flow of heat in a semi-infinite solid.												
5	15.a.	Using the method of least squares, fit a straight line to the four points <table border="1"><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1.7</td><td>1.8</td><td>2.3</td><td>3.2</td></tr></table>	x	1	2	3	4	y	1.7	1.8	2.3	3.2	K2	CO5
	x	1	2	3	4									
	y	1.7	1.8	2.3	3.2									
(OR)														
15.b.	Use (i) Trapezoidal rule (ii) Simpson's 1/3 rd rule, to evaluate the approximate value of $\int_0^1 \frac{dx}{1+x}$ correct to 3 decimals taking $h = 0.25$													

SECTION - C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Evaluate $\int_C \frac{dz}{z^2-1}$ where C is circle $x^2 + y^2 = 4$	K5	CO1
2	17	Derive Fourier sine and cosine transform of a derivative	K3	CO2
3	18	Give out the Rodrigue formula for Legendre Polynomial	K2	CO3
4	19	Derive the solution for Laplace Equation in spherical polar coordinates	K3	CO4
5	20	Use Runge Kutta method to find by (0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$, take $h = 0.2$	K2	CO5

Z-Z-Z

END