Printed page: 3 **Subject Code: AAS0301A**

Roll No: | | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY , GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

(SEM: III THEORY EXAMINATION (2021-2022)

Subject Name: Engineering Mathematics-III

Time: 3 Hours **Max. Marks:100**

General Instructions:

- All questions are compulsory. It comprises of three Sections, A, B, and C.
- **Section A** -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each.
- **Section B -** Question No-3 is Long answer type -I question with external choice carrying 6 marks each.
- **Section C** - Question No. 4-8 are Long answer type –II (within unit choice) questions carrying 10 marks e**ach**.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

		SECTION – A		
1.	**Attempt all questions.**		**[10×1=10]**	**CO**
	a.	The function $f(z) = \|z\|^2$ is (i) Continuous and differentiable everywhere (ii) Continuous at $z = 0$ but not differentiable at $z = 0$ (iii) Continuous everywhere but nowhere analytic (iv) none of these	**(1)**	**CO1**
	b.	A function is said to be harmonic if (a) $u_{xx} + u_{yy} = 0$ (b) $u_{xx} + u_{xy} = 0$ (c) $u_{xx} - u_{yy} = 0$ (d) none of these	**(1)**	**CO1**
	c.	For the function $\frac{Sin\ z}{z^3}$ of a complex variable z, the point $z = 0$ is a (a) Pole of order 3 (b) pole of order 2 (c) Pole of order 1 (d) none of these	**(1)**	**CO2**
	d.	If C is a circle $\|z\| = 1$, then $\oint_c \bar{z}\ dz$ is (a) πi (b) 2 πi (c) 0 (d) none of these	**(1)**	**CO2**
	e.	The C.F. of partial differential equation $(D + 4D' + 5)^3 z = 0$ is……	**(1)**	**CO3**
	f.	Classify the operator $4\,u_{xx} + 4\,u_{xt} + u_{tt} = 0$ as Hyperbolic, Parabolic and Elliptic . Symbols have their usual meanings.	**(1)**	**CO3**
	g.	The value of $\Delta f(x)$ will be (a) $f(x+h) - f(x)$ (b) $f(x+h)$ $(c)\ f(x-h)$ (d) none of these	**(1)**	**CO4**
	h.	The Lagrange's interpolation formula can be used when the values $x_0, x_1, x_2, \ldots\ldots x_n$ are (a) Zero spaced only (b) Unequally spaced only (c) Equally spaced or not (d) None of these	**(1)**	**CO4**

	i.	A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour? (a) 3.6 (b) 7.2 (c) 8.4 (d) 10	**(1)**	**CO5**
	j.	A, P, R, X, S and Z are sitting in a row. S and Z are in the centre. A and P are at the ends. R is sitting to the left of A. Who is to the right of P? (i) A (ii) X (iii) S (iv) Z	**(1)**	**CO5**
2.	**Attempt all questions.**		**[5×2=10]**	**CO**
	a.	Explain analytic function with examples.	**(2)**	**CO1**
	b.	Discuss the nature of singularity of $f(z) = \sin\frac{1}{z}$ at z=0.	**(2)**	**CO2**
	c.	Differentiate between one dimensional and two dimensional heat conduction equation.	**(2)**	**CO3**
	d.	Differentiate Regula falsi method and Newton Raphson method.	**(2)**	**CO4**
	e.	State true/False : If two pipes take x and y hours respectively to fill a tank of water and a third pipe is opened which takes z hours to empty the tank, then the time taken to fill the tank = {1 / (1/x)+(1/y)+(1/z)} and the net part of the tank filled in 1 hr = (1/x)+(1/y)-(1/z) .	**(2)**	**CO5**
		SECTION – B		
3.	**Answer any five of the following-**		**[5×6=30]**	**CO**
	a.	An electrostatic field in the xy-plane is given by the potential function $\emptyset = 3x^2y - y^3$, find the stream function.	**(6)**	**CO1**
	b.	Evaluate $\oint_C \frac{e^{-z}}{z+1}\, dz$, where C is the circle (i) $\|z\| = 2$ (ii) $\|z\| = 1/2$.	**(6)**	**CO2**
	c.	Solve : $r + s - 2t = \sqrt{2x + y}$, where symbols have their usual meanings.	**(6)**	**CO3**
	d.	Using Newton's backward formula to obtain y_8: given $y_1 = 9, y_3 = 21,\ y_5 = 81, y_7 = 237,\ and\ y_9 = 537.$	**(6)**	**CO4**
	e.	A man takes 20 minutes to row 12 km upstream which is a third more than the time he takes on his way downstream. What is his speed in still water?	**(6)**	**CO5**
	f.	Show that $f(z) = \sin z$ is analytic in the entire z-plane.	**(6)**	**CO1**
	g.	Evaluate the integral $\int_4^{5.2} \log x\, dx$ using trapezoidal rule.	**(6)**	**CO4**
		SECTION – C		
4	**Answer any one of the following-**		**[5×10=50]**	**CO**
	a.	Find the transformation which maps the points $z = 1, -i, -1$ to the points $w = i, 0, -i$ respectively. Show also that this transformation maps the region outside the circle $\|z\| = 1$ into the half plane $Re(w) \geq 0$.	**(10)**	**CO1**
	b.	If $f(z) = \begin{cases} \frac{x^3y(y-ix)}{x^6+y^2}, z \neq 0 \\ \end{cases}$ and $f(0) = 0$. Prove that $\frac{f(z)-f(0)}{z} \to 0$ as $z \to 0$ along any radius vector but not as $z \to 0$ in other manner and also that $f(z)$ is not analytic at $z = 0$ even though C-R equations are satisfied there.	**(10)**	**CO1**

5.	**Answer any one of the following-**			
	a.	Expand $f(z) = \frac{1}{(z+1)(z+3)}$ in a Laurent's series valid for the regions (i) $\lvert z\rvert < 1$ (ii) $1 < \lvert z\rvert < 3$ (iii) $\lvert z\rvert > 3$.	**(10)**	**CO2**
	b.	Prove that $\int_0^{2\pi} \frac{1+2\cos\theta}{5+4\cos\theta}\, d\theta = 0$.	**(10)**	**CO2**
6.	**Answer any one of the following-**			
	a.	Solve $\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{2x-y} + \cos(x+2y)$.	**(10)**	**CO3**
	b.	Solve the equation by the method of separable of variables: $\frac{\partial^2 z}{\partial x \partial y} = e^{-y}\cos x$ given that $z=0$ when $y=0$ and $\frac{\partial z}{\partial x} = 0$ when x=0.	**(10)**	**CO3**
7.	**Answer any one of the following-**			
	a.	Using Runge-Kutta method find y(1.2) in step size h=0.1, given that $\frac{dy}{dx} = x^2 + y^2$ with y(1)=1.5 .	**(10)**	**CO4**
	b.	Find a real root of the equation $x\, log_{10} x = 1.2$ by bisection method correct to four decimal places.	**(10)**	**CO4**
8.	**Answer any one of the following-**			
	a.	A boat travels from point A to B, a distance of 12 km. From A it travels 4 km downstream in 15 minutes and the remaining 8 km upstream to reach B. If the downstream speed is twice as high as the upstream speed, what is the average speed of the boat for the journey from A to B?	**(10)**	**CO5**
	b.	Read the information given below and answer the following questions: A total of 10 people, 5 men and 5 women are sitting in two parallel lines, facing each other. Five men, namely, Ajit, Bharat, Chirag, Dharam and Ejaz are facing to the south and the five women, Meenal, Neelu, Octavia, Preeti and Arpita are facing towards the north. • Bharat, who is just next to the left of Dharam, is opposite to Arpita. • Chirag and Neelu are diagonally opposite to each other. • Ejaz is opposite Octavia who is just next to Meenal. • Preeti, who is just to the left of Arpita, is opposite to Dharam. (i) Meenal is at one end of the line Which two people are sitting at the two extreme ends of the line? (ii) Who is sitting right in front of Dharam? (iii) Who sits exactly in between Meenal and Neelu? (iv) Who sits opposite to Octavia? (v) Who is sitting at the right corner of the women's line?	**(10)**	**CO5**