

## **ASSIGNMENT PAPERS**

### **Semester-I (M.Sc. Mathematics)**

<b>Session: 2025-26</b>		
<b>Program Name: MSc-Mathematics</b>		
<b>Course Code: PGMM-101N</b>		<b>Course Name: Advanced Real Analysis and Integral Equations</b>
<b>SECTION -A</b>		<b>2*6=12 marks</b>
<b>Q. No.</b>	<b>Short answer type question (approx. 200 -300 words)</b>	<b>Marks</b>
<b>1.</b>	What do you mean by Lower and Upper Riemann integral? OR Define Cauchy's criterion for uniform convergence.	2
<b>2.</b>	If $f$ be a continuous function on $[a, b]$ and $F(x) = \int_a^x f(t) dt$ for all $x \in [a, b]$ then prove that $F'(x) = f(x)$ . OR Explain the Cauchy's theorems on limits.	
<b>3.</b>	Explain the higher order partial derivatives. OR Find the first order partial derivatives $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$ when $u = \tan^{-1} \frac{y}{x}$ .	2
<b>4.</b>	Show that $\lim_{(x,y) \rightarrow (0,0)} \frac{2x^3 - y^3}{x^2 + y^2} = 0$ . OR Verify that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ if $u = ax^2 + 2hxy + by^2$ .	2
<b>5.</b>	Define Half Range Fourier series. OR Explain the Fredholm integral equation?	2
<b>6.</b>	Describe the Volterra integral equations. OR Use the method of Laplace Transform to solve the integral equation. $u(x) = x - \int_0^x (x - \xi) u(\xi) d\xi.$	2

	<b>SECTION -B</b>	<b>6*3=18 marks</b>
	<b>Long answer type question (approx. 500 -800 words)</b>	<b>Marks</b>
<b>7.</b>	<p>If <math>u = \tan^{-1} \left[ \frac{x^3 + y^3}{x + y} \right]</math>, then show that <math>x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u</math>.</p> <p>OR</p> <p>If <math>x^x y^y z^z = c</math>, then show that <math>x = y = z</math>, <math>\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}</math>.</p>	3
<b>8.</b>	<p>Prove that <math>\frac{\partial(u, v, w)}{\partial(x, y, z)} \times \frac{\partial(x, y, z)}{\partial(u, v, w)} = 1</math>.</p> <p>OR</p> <p>Verify Euler's theorem, where <math>u = \frac{x(x^3 - y^3)}{x^3 + y^3}</math>.</p>	3
<b>9.</b>	<p>Find the Fourier series of the function in interval <math>f(x) = x^2</math> in the interval <math>(-\pi, \pi)</math>.</p> <p>OR</p> <p>Reduce the integral equation <math>\sin x = \lambda \int_0^x e^{x-\xi} u(\xi) d\xi</math> to the second kind and hence solve it.</p>	3

Session: 2025-26		
Program Name: <b>MSc-Mathematics</b>		
Course Code: <b>PGMM-102N</b>	Course Name: <b>Classical Optimization Techniques</b>	
<b>SECTION -A</b>		<b>2*6=12 marks</b>
<b>Q. No.</b>	<b>Short answer type question (approx. 200 -300 words)</b>	<b>Marks</b>
<b>1.</b>	Write a short note on classification of optimization problems. OR Determine the maximum and minimum value of the function $y = 3x^5 - 5x^3 + 1$ .	2
<b>2.</b>	Find the optimum solution of the constrained multivariable problem: Minimize $z = x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2$ Such that $x_1 + 5x_2 - 3x_3 = 6$ . OR Define the Fibonacci method.	2
<b>3.</b>	Explain the penalty function method. OR Describe the Kuhn-Tucker conditions.	2
<b>4.</b>	Define Hooke and Jeeve's method. OR Minimize $f(x) = 2x$ , subject to $x \geq 3$ using interior penalty method.	2
<b>5.</b>	Explain the Kuhn-Tucker conditions. OR Define the separable programming problem.	2
<b>6.</b>	State the Bellman's Principle of Optimality. OR Write the procedure of minimum spanning tree problem.	2
<b>SECTION -B</b>		<b>6*3=18 marks</b>
	<b>Long answer type question (approx. 500 -800 words)</b>	<b>Marks</b>
<b>7.</b>	Using separable programming to solve the following non-linear programming problem: $Max Z = x_1 + x_2^4$ such that $3x_1^2 + 2x_2^2 \leq 9$ , $x_1, x_2 \geq 0$ OR Solve the following problem using dynamic programming: $Min Z = x_1^2 + x_2^2 + x_3^2 + x_4^2$ s.t. $x_1 x_2 x_3 x_4 = 16$ and $x_1, x_2, x_3, x_4 \geq 0$ .	3
<b>8.</b>	Write a short note on applications of dynamic programming. OR Explain the payoff matrix.	3
<b>9.</b>	Find the all integer solution to the following Integer Linear Programming Problem (ILPP): $Max z = 3x_1 + 2x_2$ s.t. $x_1 + x_2 \leq 4$ , $x_1 - x_2 \leq 2$ , $x_1, x_2 \geq 0$ and integers. OR What do you mean by Zero-one Integer Linear programming problem?	3

Session: 2025-26		
Program Name: <b>MSc-Mathematics</b>		
Course Code: <b>PGMM-103N</b>	Course Name: <b>Discrete Mathematics</b>	
SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Find the power set of $\{1, 2\}$ . OR Let $A = \{1, 2\}$ and $B = \{3, 4\}$ . Find $A \times B$ and $B \times A$ .	2
2.	What do you means by Cartesian product of sets? OR Define injective and bijective mappings with examples.	
3.	State the principle of inclusion-exclusion. OR Prove that each of the following is a tautology: (a) $p \wedge q \rightarrow p$ (b) $p \rightarrow (p \vee q)$	2
4.	Prove the following tautological equivalences: (i) $(p \rightarrow q) \vee (p \rightarrow r) \equiv p \rightarrow q \vee r$ OR Explain the principle of mathematical induction.	2
5.	Define Boolean Algebra. OR Define Lattice with examples.	2
6.	What do you mean by graph and simple graph? OR Define the rooted tree.	2
SECTION -B		6*3=18 marks
	Long answer type question (approx. 500 -800 words)	Marks
7.	Give an example of a relation that is reflexive but neither symmetric nor transitive. OR In a school, assuming sport participation is compulsory. In a class of 80 students, 60 play football and 40 play basketball. Find: (i) How many play both the games. (ii) Play football only.	3
8.	Define the Hasse diagram with examples. OR Explain cycle, path and circuit with examples.	3
9.	Write a note on graph coloring. OR Explain Kruskal's algorithm.	3

Session: 2025-26																		
Program Name: <b>MSc-Mathematics</b>																		
Course Code: <b>PGMM-104N</b>			Course Name: <b>Numerical Analysis</b>															
SECTION -A						2*6=12 marks												
Q.No.	Short answer type question (approx. 200 -300 words)					Marks												
1.	What do you mean by finite differences?  OR  Prove that $\Delta^2 \equiv E^2 - 2E + 1$ .					2												
2.	If $f(0) = -3, f(1) = 6, f(2) = 8, f(3) = 12$ prepare the forward difference table.  OR  Determine the missing term in the following table: <table><tr><td><math>x</math></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td><math>f(x)</math></td><td>1</td><td>3</td><td>9</td><td>—</td><td>81</td></tr></table>					$x$	0	1	2	3	4	$f(x)$	1	3	9	—	81	2
$x$	0	1	2	3	4													
$f(x)$	1	3	9	—	81													
3.	Write the Lagrange's Interpolation Formula for unequal intervals.  OR  Explain the Gauss' Seidel Method.					2												
4.	What do you mean by LU Decomposition method?  OR  Explain the procedure for solving algebraic equation by Newton-Raphson's method.					2												
5.	Write the procedure for solving algebraic equation by Bisection method.  OR  Explain the Regula-Falsi Method.					2												
6.	When we use Stirling difference formula for derivaties.  OR  Use Euler's method compute the value of $y(0.04)$ for the differential equation $\frac{dy}{dx} = -y$ with $y=1$ at $x=0$ .					2												

	<b>SECTION -B</b>	<b>6*3=18 marks</b>																						
	<b>Long answer type question (approx. 500 -800 words)</b>	<b>Marks</b>																						
<b>7.</b>	<p>Use Gauss Backward Interpolation formula to obtain the values of the function <math>f(x)</math> at <math>x=5.8</math>:</p> <table><tr><td><math>x</math></td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td><math>y = f(x)</math></td><td>270</td><td>648</td><td>1330</td><td>2448</td></tr></table> <p style="text-align: center;">OR</p> <p>Using the Lagrange's formula to find the polynomial which includes the following values of <math>x</math> and <math>y</math>.</p> <table><tr><td><math>x</math></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td><math>y = f(x)</math></td><td>3</td><td>6</td><td>11</td><td>18</td><td>27</td></tr></table>	$x$	4	5	6	7	$y = f(x)$	270	648	1330	2448	$x$	0	1	2	3	4	$y = f(x)$	3	6	11	18	27	3
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$y = f(x)$	3	6	11	18	27																			
<b>8.</b>	<p>Solve the following system of equation by Gauss elimination method: <math>2x + y + z = 10</math> , <math>3x + 2y + 3z = 18</math> , <math>x + 4y + 9z = 16</math></p> <p style="text-align: center;">OR</p> <p>Apply Crout's method to solve</p> $5x_1 + 2x_2 + x_3 = -12, -x_1 + 4x_2 + 2x_3 = 20,$ $2x_1 - 3x_2 + 10x_3 = 3.$	3																						
<b>9.</b>	<p>Calculate an approximate value of the integral <math>\int_0^{x/2} \sin x dx</math> by (i) Trapezoidal rule (ii) Simpson's one third rule (iii) Simpson's three-eighth rule.</p> <p style="text-align: center;">OR</p> <p>Solve the equation <math>\frac{dy}{dx} = x + y</math> with initial condition <math>y(0)=1</math> by Runge – Kutta's rule from <math>x = 0</math> to <math>x = 0.4</math> with <math>h = 0.1</math>.</p>	3																						

### **ASSIGNMENT PAPER**

<b>Session: 2025-26</b>	<b>Max. Marks: 30</b>
<b>Program Name: M.Sc. (Statistics/Computer Science/Mathematics/ Bio chemistry/ Environmental Science)</b>	
<b>Course Code: PGBR-01</b>	<b>Course Name: Basics in research</b>

<b>SECTION -A</b>		<b>2*6=12 marks</b>
<b>Q. No.</b>	<b>Short answer type question (approx. 200 -300 words)</b>	<b>Marks</b>
<b>1</b>	Write down the meaning and objective of research.	<b>2</b>
<b>2</b>	Discuss the need for reviewing literature in brief. What are the types of literature review?	<b>2</b>
<b>3</b>	What do you understand by google scholar, science direct?	<b>2</b>
<b>4</b>	What do you understand by google Scopus, web of science?	<b>2</b>
<b>5</b>	write short notes on the following- a) Journal abstracts b) SciFinder	<b>2</b>
<b>6</b>	Write short notes on the following- a) Citation index b) Peer review and revision.	<b>2</b>
<b>SECTION -B</b>		<b>6*3=18 marks</b>
	<b>Long answer type question (approx. 500 -800 words)</b>	<b>Marks</b>
<b>7</b>	Discuss in detail about the intellectual property and intellectual property rights (IPR).	<b>6</b>
<b>8</b>	write short notes on the following- a) Citation index b) Peer review and revision.	<b>6</b>
<b>9</b>	What are the various kinds of report writing in academics and research. Explain in detail.	<b>6</b>