



Republic of the Philippines  
**CEBU NORMAL UNIVERSITY**  
Osmeña Blvd. Cebu City, 6000 Philippines

**RESEARCH INSTITUTE  
FOR COMPUTATIONAL  
MATHEMATICS AND PHYSICS**  
Email: ricmp@cnu.edu.ph  
Website: www.cnu.edu.ph/ricmp/home



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## YEAR-END REPORT (C.Y. 2022)

This report is based on the following goals of the Research Institute for Computational Mathematics and Physics:

- Perform research of high quality in the field of computational mathematics and physics
- Develop tools and methodologies based on computational mathematics and physics for the use in teaching and learning as well as in industries.

Below are the highlights of the accomplishments of the research institute for CY 2020:

- **Perform research of high quality in the field of computational mathematics and physics**
  - The institute has conducted/organized the following training-workshop:

<b>Name of Seminars, Trainings, and Conferences</b>	<b>Date and Venue</b>	<b>Involvement</b>	<b>Acquired</b>
<b>RICMP Lecture Series 2 and Research Proposal Write-shop</b>	<b>Date:</b> February 18-19, 2022 <b>Venue(Virtual):</b> Zoom	<i>Resource Speaker:</i> <b>Dr. Cristina B. Corcino</b> RICMP Researcher  <i>Title of the Talk:</i> <b>1) Fourier Series of Some Special Functions;</b> <b>2) Asymptotic Approximation of Some Special Functions Using Fourier Series</b>	Tools and methodologies in conducting research on Generalization of Lambert W Function and Its Applications  9 Full-Blown Research Project Proposals

<b>Lecture Series and Training Workshop on Advanced Methods in Mathematical Research</b>	<b>Date:</b> September 28-30, 2022 <b>Venue:</b> Cebu Business Hotel, Cebu City	<i>Resource Speakers:</i> <b>Dr. Istvan Mezo</b> Research Professor, Nanjing University of Information Science and Technology (NUIST), Nanjing, China  <b>Ms. Baby Ann Damgo</b> <b>Ms. Joy Ann Cañete</b> <b>Mr. Wilson Castañeda</b> <i>RICMP Research Collaborators</i>	Updates on the Advanced Methods in Mathematical Research  Research project Proposals  Review of Research Project Proposals for RICMP Funding in 2023
<b>Lecture Series and Training Workshop on Writing Publishable Mathematics Articles</b>	<b>Date:</b> November 14-16, 2022 <b>Venue:</b> Cebu Business Hotel, Cebu City	<i>Resource Speakers:</i> <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>  <b>Dr. Cristina B. Corcino</b> <i>RICMP Researcher Research Chair, CAS Science</i>  <b>Ms. Baby Ann Damgo</b> <b>Ms. Joy Ann Cañete</b> <b>Mr. Wilson Castañeda</b> <i>RICMP Research Collaborators</i>	Completion of All the Research Projects Funded by RICMP in 2022  Draft of Publishable Articles Containing the Results from the Research Projects Funded by RICMP in 2022

- The researchers of the institute have attended the following seminars, trainings, and conferences:

<b>Name of Seminars, Trainings, and Conferences</b>	<b>Date and Venue</b>	<b>Involvement</b>	<b>Acquired</b>
<b>Board Meeting of the Mathematical Society of the Philippines (MSP)</b>	<b>Date:</b> February 11, 2022 (3:30pm) <b>Venue(Virtual):</b> Zoom	<b>Dr. Roberto B. Corcino</b> <i>Board Member Chair of Selection Committee, MSP Research Awards</i>	Popularity of RICMP in the national community of math researchers  Future research collaboration with other SUCs

<p><b>Lecture Series on Basic Calculus</b></p> <p><b>Outreach/Extension Program titled “Math for Senior High”</b></p>	<p><b>Date:</b> March 18, 2022  <b>Venue(Virtual):</b> Zoom</p>	<p><i>Resource Speaker:</i>  <b>Dr. Roberto B. Corcino</b></p> <p><i>Title of the Talk:</i>  <b>The Derivative of a Function and Slope of Tangent Line</b></p>	<p>Popularity of RICMP in Cebu LGUs and DepEd-7</p>
<p><b>Board Meeting of the Mathematical Society of the Philippines (MSP) Region VII Chapter</b></p> <p><b>(Election of MSP Region VII Officers)</b></p>	<p><b>Date:</b> March 19, 2022  <b>Venue(Virtual):</b> Zoom</p>	<p><b>Dr. Roberto B. Corcino</b>  <i>Board Member  President of MSP  Region VII Chapter</i></p> <p><b>Dr. Cristina B. Corcino</b>  <i>Board Member  Vice-President of MSP  Region VII Chapter</i></p> <p><b>Dr. Cris Armada</b>  <i>Board Member  Secretary of MSP  Region VII Chapter</i></p> <p><b>Dr. Edward Kiunisala</b>  <i>Board Member  MSP Region VII Chapter</i></p>	<p>Popularity of CNU RICMP in Region VII community of math researchers</p> <p>Future research collaboration with other SUCs</p>
<p><b>Internationalization-by-Design Institutional Strategy and Policy Development</b></p>	<p><b>Date:</b> April 1, 2022  <b>Venue:</b> EMMA Center, Cebu Normal University, Cebu City</p>	<p><i>Participant</i></p>	<p>Updates on CNU strategies on internationalization</p>
<p><b>Board Meeting of the Mathematical Society of the Philippines (MSP)</b></p> <p><b>(Preparation for the Upcoming MSP Annual Convention)</b></p>	<p><b>Date:</b> April 4, 2022 (3:30pm)  <b>Venue(Virtual):</b> Zoom</p>	<p><b>Dr. Roberto B. Corcino</b>  <i>Board Member  Chair of Selection Committee, MSP  Research Awards</i></p>	<p>Popularity of RICMP in the national community of math researchers</p> <p>Future research collaboration with other SUCs</p>

<b>Webinar on Ethics and Research in the Social Sciences</b>	<b>Date:</b> April 11, 2022 <b>Venue(Virtual):</b> Zoom	<i>Participant</i>	Updates on ethics and research in the social sciences
<b>Board Meeting of the Mathematical Society of the Philippines (MSP)</b>  <b>(Updates on the Preparation for the Upcoming MSP Annual Convention)</b>	<b>Date:</b> April 20, 2022 (3:30pm) <b>Venue(Virtual):</b> Zoom	<b>Dr. Roberto B. Corcino</b> <i>Board Member Chair of Selection Committee, MSP Research Awards</i>	Popularity of RICMP in the national community of math researchers  Future research collaboration with other SUCs
<b>CHED HEDF Regional Monitoring and Reconciliation Workshop</b>	<b>Date:</b> April 26, 2022 <b>Venue:</b> Seda Central Bloc Cebu, Cebu City	<i>Participant</i>	Reconciliation of the liquidation report of the recently completed research projects of RICMP funded by CHED-GIA
<b>PAGHAHABI: Interweaving Mathematics and Life</b>  <b>A Seminar-Project of PhD Science Education (Math) students in West Visayas State University</b>	<b>Date:</b> April 30, 2022 <b>Venue(Virtual):</b> Zoom	<i>Resource Speaker:</i> <b>Dr. Roberto B. Corcino</b> RICMP Director	Popularity of CNU RICMP in Visayas Region community of math researchers  Future research collaboration with other SUCs
<b>Board Meeting of the Mathematical Society of the Philippines (MSP)</b>  <b>(Updates on the Preparation for the Upcoming MSP Annual Convention)</b>	<b>Date:</b> May 4, 2022 (3:30pm) <b>Venue(Virtual):</b> Zoom	<b>Dr. Roberto B. Corcino</b> <i>Board Member Chair of Selection Committee, MSP Research Awards</i>	Popularity of RICMP in the national community of math researchers  Future research collaboration with other SUCs
<b>35<sup>th</sup> AUAP Annual Conference on Higher Education Challenges in the Post-COVID19 World</b>	<b>Date:</b> May 13, 2022 <b>Venue(Virtual):</b> Zoom	<i>Participant</i>	Updates on Global Challenges and Problems in Higher Education, which are possible source of research problems

<b>Writeshop on Synergizing and Launching of CNU's Research Directions</b>	<b>Date:</b> May 18-20, 2022 <b>Venue:</b> Tandang Sora Hall, Cebu Normal University, Cebu City	<i>Participant</i>	New Research Agenda for Mathematics and Physics
<b>2022 Mathematical Society of the Philippines (MSP) Annual Convention</b>	<b>Date:</b> May 21, 28 and June 4, 2022 <b>Venue(Virtual):</b> Zoom	Part of the Organizing Committee <b>Dr. Roberto B. Corcino</b> <i>Member, Board of Directors of MSP National Chair, Screening Committee of MSP Research Grant Member, Registration and Membership Committee</i>  <b>Dr. Cristina B. Corcino</b> <i>Plenary Speaker</i>	Popularity of CNU RICMP in the community of math researchers in the Philippines  Future research collaboration with other SUCs
<b>Outstanding Young Scientists, Inc. (OYSI) 17<sup>th</sup> Annual Meeting and Scientific Convention (AMSC)</b>	<b>Date:</b> 12 July 2022 <b>Venue(Virtual):</b> Zoom	Participant <b>Dr. Roberto B. Corcino</b> <i>OYSI Member OYS 2008</i>	Popularity of RICMP in the national community of researchers  Future research collaboration with other SUCs
<b>National Academy of Science and Technology, Philippines (NAST PHL) 44<sup>th</sup> Annual Scientific Meeting (ASM)</b>	<b>Date:</b> 13-14 July 2022 <b>Venue(Virtual):</b> Zoom	Participant <b>Dr. Roberto B. Corcino</b> <i>OYSI Member OYS 2008</i>	Popularity of RICMP in the national community of researchers  Future research collaboration with other SUCs
<b>CAS Balik Scientist: Lecture-Seminar on Trends, Issues and Nanotechnology Innovations of CAS</b>	<b>Date:</b> 15 August 2022 <b>Venue:</b> CNU Tandang Sora Hall	Participant <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>	Updates on Trends, Issues and Nanotechnology Innovations

<b>Training Workshop on Framing the Futures of CNU: Scoping for Cebu Normal University Futures Thinking Agenda</b>	<b>Date:</b> 22-24 August 2022 <b>Venue:</b> Waterfront Hotel Cebu City	Participant <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>	Crafting of RICMP Futures Thinking Research Agenda
<b>Webinar on the Establishment of Region 8 Chapter of the Mathematical Society of the Philippines (MSP)</b>	<b>Date:</b> 8 August 2022 <b>Venue(Virtual):</b> Zoom	<i>Resource Speaker</i> <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i> <i>MSP 7 President</i>	Popularity of CNU RICMP in the community of math researchers in the Philippines  Future research collaboration with other SUCs
<b>4th International Conference for Arts and Sciences (I-CAS) with the theme "Strengthening the Innovative Culture of Arts and Sciences"</b>	<b>Date:</b> September 21 & 22, 2022 <b>Venue(Virtual):</b> Zoom	Participant <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>	Updates on Research Trends in Arts and Sciences
<b>Training-Workshop on Writing Systematic Review and Meta-Synthesis Research Paper</b>	<b>Date:</b> September 26-28, 2022 <b>Venue:</b> One Central Hotel, Cebu City	Participant <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>	Advanced Methods on Writing Systematics Review and Meta-Synthesis Research Paper
<b>Joint International Conference Taiwan-Philippines-Japan Academic Conference and CNU FIRE</b>	<b>Date:</b> November 28-29, 2022 <b>Venue:</b> Marco Polo Hotel, Cebu City	Session Head: <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>  Paper Presenters: <b>Dr. Roberto B. Corcino</b> <i>RICMP Director</i>  <b>Dr. Cristina B. Corcino</b> <i>RICMP Researcher</i>  <i>Submitted Entries for Infomercial and Infographics</i>	Popularity of CNU RICMP in the international community of researchers  Future research collaboration with other SUCs

<p><b>2022 MSP Region VII Research Congress and Convention</b></p>	<p><b>Date:</b> December 2 and 9, 2022  <b>Venue (Virtual):</b> Zoom hosted by USJR</p>	<p>Members of the Organizing Committee:  <b>Dr. Roberto B. Corcino</b>  <i>RICMP Director</i>  <i>MSP 7 President</i></p> <p><b>Dr. Cristina B. Corcino</b>  <i>RICMP Researcher</i>  <i>MSP 7 Vice President</i></p> <p><b>Dr. Cris Armada</b>  <i>RICMP Researcher</i>  <i>MSP 7 Secretary</i></p> <p><b>Dr. Edward Kiunisala</b>  <i>RICMP Researcher</i>  <i>MSP 7 Board Member</i></p>	<p>Popularity of CNU RICMP in the community of math researchers in the Philippines</p> <p>Future research collaboration with other SUCs</p>
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- The institute has produced the following completed researches and publications in journals indexed by **Web of Science, Scopus and Asian Citation Index:**

<b>Title</b>	<b>Status</b>	<b>Date of Completion/ Publication</b>
<p><b><i>Integral Representation and Explicit Formula at Rational Arguments for Apostol–Tangent Polynomials</i></b></p> <p>Cristina B. Corcino, Baby Ann Damgo, Joy Ann Cañete and Roberto B. Corcino</p>	<p>Published</p> <p><i>Symmetry</i>, Volume 14 (2022), Article #35  <a href="https://doi.org/10.3390/sym14010035">https://doi.org/10.3390/sym14010035</a></p> <p>Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCIE</b>) and <b>SCOPUS</b></p>	<p>January 2022</p>
<p><b><i>Asymptotic Approximation of the Apostol-Tangent Polynomials Using Fourier Series</i></b></p> <p>Cristina B. Corcino, Baby Ann Damgo, Joy Ann Cañete and Roberto B. Corcino</p>	<p>Published</p> <p><i>Symmetry</i>, Volume 14 (2022), Article #53  <a href="https://doi.org/10.3390/sym14010053">https://doi.org/10.3390/sym14010053</a></p>	<p>January 2022</p>

	Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCIE</b> ) and <b>SCOPUS</b>	
<i>Asymptotic Approximations of Apostol-Tangent Polynomials in terms of Hyperbolic Functions</i>  Cristina B. Corcino, Wilson Castañeda, Jr. and Roberto B. Corcino	Published Online  <i>Computer Modeling in Engineering and Sciences</i> , Volume 132(1) (2022), 133-151  Indexed by <b>Web of Science</b> and <b>SCOPUS</b>	January 2022
<b>A q-analogue of generalized translated Whitney numbers: Cigler's approach</b>	Published  <i>Journal of Mathematics and Computer Science</i> , <b>24</b> (2022), 82–96.  Indexed by <b>Web of Science</b> and <b>SCOPUS</b>	January 2022
<b>A (p, q)-analogue of Qi-type formula for r-Dowling numbers</b>	Published  <i>Journal of Mathematics and Computer Science</i> , <b>24</b> (2022), 273–286.  Indexed by <b>Web of Science</b> and <b>SCOPUS</b>	January 2022
<i>Fourier Series for the Tangent Polynomials, Tangent–Bernoulli and Tangent–Genocchi Polynomials of Higher Order</i>  Cristina B. Corcino and Roberto B. Corcino	Published  <i>Axioms</i> , Volume 11 (2022), Article #86 <a href="https://doi.org/10.3390/axioms11030086">https://doi.org/10.3390/axioms11030086</a>  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCIE</b> ) and <b>SCOPUS</b>	February 2022
<b>Fourier Series Expansion and Integral Representation of Apostol-Type Frobenius–Euler Polynomials of Complex Parameters and Order <math>\alpha</math></b>	Published  <i>Symmetry</i> <b>2022</b> , <i>14</i> , 1860. <a href="https://doi.org/10.3390/sym14091860">https://doi.org/10.3390/sym14091860</a>  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCIE</b> ) and <b>SCOPUS</b>	September 2022
<b>Generalized Laguerre-Apostol-Frobenius-Type Poly-Genocchi Polynomials of Higher Order with Parameters a,b and c</b>	Published  <i>European Journal of Pure and Applied Mathematics</i> , Vol. 15, No. 4, 2022, 1549-1565	November 2022



	Indexed by <b>Web of Science</b> and <b>SCOPUS</b>	
<b>Fourier Series for Bernoulli-Type Polynomials, Euler-Type Polynomials and Genocchi-Type Polynomials of Integer Order</b>	Published <i>European Journal of Pure and Applied Mathematics</i> , Vol. 15, No. 4, 2022, 1662-1682  Indexed by <b>Web of Science</b> and <b>SCOPUS</b>	November 2022
<b>On Divisibility Property of Type 2 (p,q)-Analogue of r-Whitney Numbers of the Second Kind</b>	Completed and Submitted for Publication	August 2022
<b>Degenerate Apostol-Frobenius-Type Poly-Genocchi Polynomials of Higher Order with Parameters a and b</b>	Completed with Publishable Article	December 2022
<b>Asymptotic Expansions for large degree Tangent and Apostol-Tangent polynomials of complex order</b>	Completed with Publishable Article	December 2022
<b>Approximations of Tangent Polynomials of Complex Order</b>	Completed with Publishable Article	December 2022
<b>Fourier series expansion and Integral representation of Apostol-Frobenius type: Tangent, Bernoulli and Genocchi polynomials</b>	Completed with Publishable Article	December 2022

- The institute director, chairs, and researchers have earned the following citation records:

<b>Name</b>	<b>H-Index</b>	<b>i10-index</b>	<b>Number of Citations</b>
Dr. Roberto B. Corcino	15	22	682 (84 Citations in 2022)
Dr. Cristina B. Corcino	10	11	291 (40 Citations for 2022)
Dr. Edward Kiunisala	5	5	112 (18 Citations for 2022)

Mr. Jay M. Ontolan	4	1	43 (4 Citations for 2022)
Mr. Allan Roy Elnar	2	1	18 (4 Citations for 2022)
Dr. Cris Armada	4	1	32 (7 Citations for 2022)

- The institute has nine (9) completed research projects funded by CNU-RICMP and one (1) research project funded by CNU-CRD. Table below provides status of the research project.

<b>Title of the Research Project</b>	<b>Researchers</b>	<b>Status</b>	<b>Funding Agency/Project Cost</b>
<i>Degenerate Apostol-Type Poly-Genocchi Polynomials with Parameters <math>a</math>, <math>b</math> and <math>c</math></i>	Cristina B. Corcino, Roberto B. Corcino	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Fourier Series and Integral Representation of Apostol-Frobenius-Euler Polynomials and Apostol-Frobenius-Genocchi Polynomials of Complex Parameters and Order <math>\alpha</math></i>	Cristina B. Corcino, Roberto B. Corcino, Jeremar Casquejo	Completed  Published one paper in the <i>Axioms, an international journal indexed by Web of Science and Scopus</i>	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Asymptotic Approximation of Apostol-Frobenius-Euler Polynomials and Apostol-Frobenius-Genocchi Polynomials in Terms of Hyperbolic Functions</i>	Cristina B. Corcino, Roberto B. Corcino, and Jay M. Ontolan	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Asymptotic Approximation of Apostol-Frobenius-Euler Polynomials Of Order <math>\alpha</math> in</i>	Cristina B. Corcino Roberto B. Corcino Wilson Castañeda	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>

<i>Terms of Hyperbolic Functions</i>		Presented during the 2022 MSP Region VII Research Congress and Convention	
<i>Asymptotic Approximation of Apostol-Frobenius-Genocchi Polynomials of Order in Terms of Hyperbolic Functions</i>	Cristina B. Corcino Roberto B. Corcino Wilson Castañeda	Completed  Presented during the Taiwan-Philippines-Japan Academic Conference	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<b>Tangent Polynomials of Complex Order</b>	Cristina B. Corcino Roberto B. Corcino Baby Ann Damgo. Joy Ann Cañete	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Forcing Super Fair Domination and Forcing Disjoint Restrained Domination in Graphs</i>	Cris Armada	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Construction of Fourier series expansion of Apostol–Frobenius: Tangent, Bernoulli and Genocchi polynomials</i>	Gibson Maglasang Karl Patrick Casas Allan Roy Elnar	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Forcing Inverse Domination and Forcing Inverse Independent Domination in Graphs</i>	Cris Armada and Edward Kiunisala	Completed	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>
<i>Generalized Laguerre-Apostol-Frobenius-Type Poly-Genocchi Polynomials with Parameters <math>a</math>, <math>b</math> and <math>c</math></i>	Roberto B. Corcino Cristina B. Corcino	Completed  Published one paper in the <i>European Journal of Pure and Applied Mathematics</i> , an international journal indexed by Web of	<b>CNU-RICMP Project Cost: PhP 200,000.00</b>

		<i>Science and Scopus</i>	
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➤ International Research Collaborations/Linkages:

- a) Dr. Roberto B. Corcino (RICMP Director) has communicated Dr. Istvan Mezo (Research Professor of Nanjing University of Information Science and Technology, China) last September 28, 2022 inviting him to be the resource speaker of **Lecture Series and Training Workshop on Advanced Methods in Mathematical Research**, and to propose another research project for collaboration. Dr. Mezo has accepted the invitation.

➤ Consultancy Services:

- ✓ Dr. Roberto B. Corcino (RICMP Director) served as resource speaker during **Webinar on the Establishment of Region 8 Chapter of the Mathematical Society of the Philippines (MSP)** held on August 8, 2022 via Zoom.
- ✓ Dr. Roberto B. Corcino (RICMP Director) served as reviewer/referee of the following international journals indexed by Web of Science (Clarivate Analytics)/SCOPUS in the year 2022:
  - 1) Discrete Applied Mathematics
  - 2) Journal of Mathematics
  - 3) Journal of Function Spaces
  - 4) Integers
  - 5) Mathematics
  - 6) Recoletos Multidisciplinary Research Journal
  - 7) Symmetry

Prepared by:

**ROBERTO B. CORCINO, Ph.D.**

Director, Research Institute for Computational Mathematics and Physics