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Shodh

MNNIT RESEARCH BULLETIN

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MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY ALLAHABAD
PRAYAGRAJ-211004

Editorial Board

Message from Patron

Prof. Rajeev Tripathi, Director, MNNIT Allahabad

I am glad to see the ThirdIssue of the *Research Bulletin* "Shodh", being published by Research & Consultancy (R&C)Cellof the Institute.

The MNNIT Allahabad has an energetic team of academics, who have successfully availed funding for the projects from external agencies in the country. As a result, research not only enhanced the teaching level but also strengthened our academic profile.

The quality teaching remains our focus even during pandemic situation of COVID-19 as in online mode, we also strive to achieve merit of excellence in our research areas, including development of devices and technologies. We have successfully materialized technology transfer of our inventions.

I am also glad to see that our R&C Cell is making every effort to promote research and this Issue of bulletin will serve to share the recent technologies developed by the Institute in the lines of existing situation of pandemic.

Looking ahead, the Institute will continue to provide an environment conducive to conduct research and develop innovative technologies.

Prof. Rajeev Tripathi
Director


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Message from Dean, Research & Consultancy

Research and innovation is a continuous process. The aim of research should be betterment of products and services, of technology and processes and, above all, human life, while protecting and nurturing environment. MNNIT Allahabad has been making significant contribution in research and innovation in the service of nation and humanity for last sixty years. In the Diamond Jubilee year of its excellence, the Institute has added new feathers to its cap.

The whole world is fighting against an unknown enemy N-Corona-19. The faculty of the Institute under the visionary leadership of our Director Prof. Rajeev Tripathi rose to the occasion and innovated multiple products/ devices to help people safeguard against the onslaught of the virus. Some of these innovations have been distributed free to help the Corona warriors; some others have been transferred for commercialisation. This volume of Shodh presents a brief description of research and innovation carried out at the Institute for the benefit of learned readers and stakeholders.

We believe that your feedback shall further boost our morale and motivate our inquisitive minds to think out-of-the-box and to materialise dreams.

Geetika
Dean R&C

Foreword

It gives me immense pleasure to write this message for the Third Issue of the *Research Bulletin* "Shodh". In this Issue we have included major development of devices, etc to control/minimize the wide spread of pandemic situation of COVID-19. These devices have been as subsequent transfer of know-how to production agencies for their commercialization.

In addition, the Issue highlights the list of some of the online course concluded in recent months.

I look forward to see more and more of our research achievements being included in the "Shodh".

Prof. Nand Kishor
Editor

MNNIT Allahabad - A Glance

Motilal Nehru National Institute of Technology (MNNIT) Allahabad (formerly Motilal Nehru Regional Engineering College MNREC, Allahabad) is an institute with total commitment to quality and excellence in academic pursuits, and is among one of the leading Institutes in India. It was established in the year 1961 as a joint enterprise of Central Govt. of India and State Govt. of Uttar Pradesh in accordance with the scheme of establishment of REC's. However, with effect from 26th June, 2002 the Institute became a deemed university and an Institute of national importance, now known as Motilal Nehru National Institute of Technology. The institute offers B. Tech. programmes in nine areas of technology, M. Tech. programmes in more than twenty disciplines, MCA, MBA, MSc. as well as PhD. programmes in all branches of Engineering, Science and Management.

The infrastructure of the Institute is at par with the best Institutions in the country, the Computer Centre has state-of-the-art computing facilities, departments have modern laboratories and the library houses print as well digital learning resources.

The entire campus, including hostels, executive development centre and residential area is connected with 1.25 Gbps internet connectivity.

The Institute makes all efforts to strengthen collaborative research programmes in emerging areas of Science and Technology.The Institute promotes advanced research via (i) joint thesis and research projects with industry participation, (ii) institutional assistantships to promote PG and Doctoral programmes, (iii) administrative support to faculty members to conduct consultancy and research projects funded by external agencies.

As per National Institutional Ranking Framework (NIRF), Ministry of Human Resource and Development, Government of India, the Institute stood at 48th rank in Engineering stream in the country in 2020.

Major Research Fields in the Departments

Name of the Department	Research fields
Applied Mechanics	Computational Solid Mechanics, Composite Structures, Finite Element Analysis, Advanced Structural Systems, Kinematic and Dynamic analysis of musculoskeletal system, Damage mechanics, Sound, noise and vibration, Thermo-Fluids Engineering, Solid mechanics, Characterization of smart materials, Bone Adaptation.
Biotechnology	Agricultural Biotechnology, Bioinformatics, Bioprocess Development, Bio-energy, Environmental Biotechnology, Genetics & Genetic Engineering, Immunology, Medical Biotechnology, Microbiology, Nanoparticle based diagnostic.
Chemical Engineering	Membrane and Reactive Separation, Convective heat transfer, Chemical reaction engineering, Process Modeling and Simulation, CFD, Environmental science & engineering, Industrial hazard, Process Safety & Hazards Management, Advanced Distillation Technology, Food Technology and Bio-processing
Chemistry	Inorganic nano-chemistry, Sensor analyte, Metal organic frameworks, Nano-biotechnology, Polymers
Civil Engineering	Structural Engineering, Geotechnical Engineering, Environmental Engineering, Transportation Engineering, GIS and Remote Sensing, Environmental Geo-technology, Water Resources Engineering, Construction Engineering and Management.
Computer Science & Engineering	Software Engineering, Mobile Computing, Knowledge Based System, Real Time System, Distributed Computing, Soft Computing and Machine Learning, Image Processing, Biometrics, Pattern Recognition, Data mining, Network Security
Electrical Engineering	Power electronics, Electrical drives, Power system operation, control and protection, Smart grid challenges, Renewable energy systems, Non-linear control theories and its applications
Electronics and Communication Engineering	Data Communication and Networking, Optical Communication, Digital Signal Processing, Image Processing, Pattern Recognition, Biometrics, Mobile and ATM Network, Wireless Sensor Network, Analog and Digital Circuits, VLSI Design, Characterization of semiconductor devices
GIS Cell	GIS applications; GNSS and InSAR technology (core and application),Natural Hazard monitoring, Machine Learning applications in Geoinformatics, WebGIS, LiDAR technology, Satellite Image Processing
Humanities and Social Sciences	English Psychology Human Resource Management, Accounting & Finance.
Mathematics	Commutative algebra, Basic hypergeometric functions, Numerical analysis, Operation research, Soft computing, Cryptography, Fluid dynamics, Heat & Mass transfer, Bio-fluid mechanics, General topology, Nearness-like structures & Near set theory.
Mechanical Engineering	CAD/CAM, Manufacturing processes, Chain management, Composite materialsits characterization, Fracture and fatigue, Multi-scale machining processes, Mechanical system design, Nanocomposites characterization, Refrigeration, Cyrogenics, Heat transfer, CFD, Air-conditioning, Passive Cooling.
Physics	Experimental condensed matter physics, Theoretical physics, Nano structured thin films, Functional oxide nano-materials, Synthesis and optical, magnetic and electric properties, of 2D systems
School of Management Studies	International finance, Marketing Management, Financial management, Human Resource management, Management information systems, Entrepreneurship, Strategic Management

COVID-19 related innovative research contribution

Name of related Innovative Item/Contribution:	***In-silico* investigation of compounds as possible inhibitors for SARS-CoV2 proteins**
Name of Faculty:	Prof. Anjana Pandey
Name of the Department:	Biotechnology
Email ID:	anjanap@mnnit.ac.in

Highlights:

- In this study, virtual screening of compounds was done using Spot-Ligand 2 and AutodockVina from Drug Bank database to identify potent protein inhibitors of SARS-CoV-2.The result show some important compounds which may be potent SARS-CoV2 protein inhibitors such as InosinePranobex for Nucleocaspid protein and NSP15 Endonuclease; Gramcidin D for NSP12 RNA polymerase and main protease; Valacyclovir for Nucleocapsid protein; Suramin, Azeleic Acid and Nafamostat for NSP 12 RNA polymerase; Ombitasvir for main protease; and Cephalosporins for NSP9 Replicase protein.
- From compounds extracted from Indian herbal plants, based on the binding affinity as well as log P and log S values, Nictoflourin (from Harsingar) show high binding affinity with Main Protease, RNA binding domain of Nucleocaspid and Papain-like Protease of SARS-CoV2 whereas with a nolide (from Ashwagandha) show highest binding affinity with main protease.

Name of related Innovative Item/Contribution:	**Computational studies to identify potential inhibitors for prevention of corona virus infections**
Name of Faculty:	Prof Anjana Pandey
Name of the Department:	Biotechnology
Email ID:	anjanap@mnnit.ac.in

Highlights:

- Corona viruses (CoVs) are a group of enveloped, single-stranded genomic RNA viruses. They are responsible for some human respiratory diseases, including Severe Acute Respiratory Syndrome (SARS) and the ongoing corona virus disease-19 (COVID-19). One key step in viral infection is entry of virus into the host cells. Therefore, targeting the endocytic pathway has become important strategy for therapeutic purpose to fight with CoVs. Inhibitors that target the endocytic pathway, have shown therapeutic potential in treatment of COVID-19.
- CoVs follow the receptor mediated endocytic pathway. Hence, we have screened the compounds via virtual screening, capable to target receptor mediated endocytosis. Screened compounds were docked with receptor protein using Autodock and binding energies were calculated. **Four compounds** were identified as potential inhibitors of receptor mediated endocytosis after ADME and toxicity analysis, thus inhibiting the corona virus infection.

Name of related Innovative Item/Contribution: **AMRIT (Assessment, Monitoring, Reporting and Intelligent Tracking) App**

Team: Dr. Ashutosh, Dr.Ambak, Dr. Sameer, Dr. N.K. Singh, Prof. Shivesh Sharma, Prof. Geetika, Vikalp Singh, Himanshu Kashyap and Prof. Rajeev Tripathi

This mobile based application has been designed to track patients having cough, cold, fever or breathing problem. Once the software is downloaded and installed, the user can register with following options:

1. Patient/customer
2. Medical shop owner
3. Medical practitioner
4. Asha Worker

AMRIT (Assessment, Monitoring, Reporting and Intelligent Tracking) is a mobile app developed under "Design Innovation Centre" a project under Ministry of Human Resource Development, Govt. of India. It will submit information about suspected corona patients easily to the administration or corona control rooms.

District Magistrate Shri Bhanu Chandra Goswami launched the AMRIT app in Sangam Sabhagar. He added that AMRIT app will help in preventing community level spread of COVID-19 infections. CMO Dr. Bajpayee told that we are hopeful that AMRIT app will be helpful to administration in tracking suspected corona patients with the support of nursing homes, drug dealers and ASHA workers.

On this launch occasion, Director, MNNIT, Prof. Rajeev Tripathi, Dean (R&C) Prof. Geetika, Registrar Dr. Sarvesh K. Tiwari and team members were also present.

Launch of Amrit App

Name of related Innovative Item/Contribution:	**VIRALYSER UV-C**
Team:	Dr. Sameer Srivastava, Dr. Ambak K. Rai, Dr. Ashutosh Mani, Dr. N.K. Singh, Prof. Shivesh Sharma and Prof. Rajeev Tripathi.

Social distancing and self-isolation have increasingly become the norm during COVID-19 pandemic. This has led to increased delivery of items to our door steps which may be contaminated with novel corona viruses as well. In addition, the chances of getting exposed through the usage of files, papers, currency and other inanimate objects has also increased. Developed under the MHRD sponsored "Design Innovation Centre" scheme, this initiative to fabricate Viralyser and Viro-Shield was taken up.

A low cost portable device to sanitize exposed surfaces of inanimate items such as; groceries, currency notes, postal letters, files etc named as "**VIRALYSER"** was developed.

As a part of social responsibility, Viralyser has been donated to the followings :

- District Magistrate, Prayagraj, U.P
- High Court, Allahabad, Prayagraj, U.P.
- Superintendent of Police (Vigilance), Prayagraj, U.P
- CMO Office, Prayagraj, U.P.

Union Cabinet Minister for Education, Government of India Dr. Ramesh Pokhriyal Nishank tweeted about the Viralyser developed by MNNIT Allahabad

Viralyser being handed to District Magistrate Office

Viralyser being handed to Superintendent of Police (Vigilance)

Name of related Innovative Item/Contribution: **Low cost, disposable face shield: Viro-Shield**

Team: The team at MNNIT fabricated a low cost and disposable face shield, named **"Viro-Shield",** which is made up of a transparency sheet and expanded polyethylene foam (EPF) which is suitable to health care workers in ICU as well as diagnostic set up and other places. Besides, it can also be used by police and corona workers particularly in areas designated as hotspots and/or red zones.

As a part of social responsibility, Viroshield has been donated to the following:

- CMO Prayagraj
- Kaushambi District Administration
- DM Office Prayagraj
- Superintendent of Police (Vigilance), Prayagraj, U.P
- Allahabad Medical Association
- Hospitals / Blood Bank / AMA & other Stakeholders
- Security Personnel (MNNIT Allahabad)

Health Centre (MNNIT Allahabad), Various other sections of MNNIT Allahabad viz., civil maintenance, lawns and gardens, library & hostels etc.

Distribution of Viroshield to Security Personnel (MNNIT Allahabad)

Distribution of Viroshield to Medical Staff (MNNIT Allahabad)

Distribution of Viroshield to CMO Allahabad

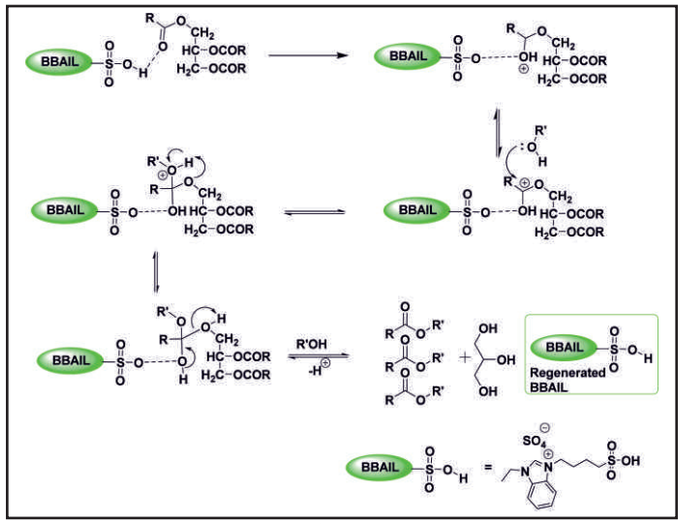
Distribution of Viroshield to District Administration Kaushambi

Major Research Highlights

Research Project Topic:	**In situ biodiesel production from microalgae using ultrasonic assisted reactor**
Funding agency:	*SERB, New Delhi*
Name of Faculty member:	*Dr.Dipesh Shikchand Patle*
Name of the Department:	*Chemical Engineering*
Faculty member email ID:	dipesh-patle@mnnit.ac.in

***Abstract of research with results*:**

Energy security, petroleum price, depletion of fossil fuels and environmental concerns have prompted considerable interest in research and development of biomass-derived fuels, such as biodiesel. This research aims at oil extraction from algal biomass and biodiesel synthesis in a single step and designing a complete process for the commercial implementation. A complete industrial scale process has been developed after establishing the feasibility of ionic liquid catalyzed and ultrasound assisted biodiesel production from microalgae (Scenedesmus*Sp.*). Later, a detailed costing of the full scale process has been carried out: capital cost, cost of manufacturing, payback period, revenue, and total annual cost. Subsequently, multiobjective optimization (MOO) has been conducted considering the objectives of current interests such as environmental and economic objectives, in particular minimization of energy requirement and maximization of the profit. MOO was carried out using stochastic evolutionary algorithm to determine the Pareto optimal fronts for these conflicting objectives. The simulator developed using Aspen Plus software was interlinked with the MOO optimizer implemented in Visual Basics Application (VBA). Finally, plantwide control (PWC) of the developed process has been studied using a systematic and hierarchal integrated framework of simulation and heuristics (IFSH) method to ensure the efficient and safe operation.



Scheme 1: Plausible reaction mechanism

Impact of research works:

Based on my presentation and the performance during project review meet that was organized by SERB at IIT Madras on 05-12-2019, I was awarded **"Very Good"** grade by the expert committee**.**

Outcome of the project:

Scope for patent application is being explored.

Recently Awarded Research Projects

Research Project Topic:	Study on Cyber-physical Approach for Electric Power Grid (File Number: CRG/2019/000951)
Funding agency:	*SERB, New Delhi*
Name of Faculty member:	*Dr. Nand Kishor (PI), Dr. Shubhi Purwar (Co-PI)*
Name of the Department:	*Electrical Engineering*
Faculty member email ID:	nandkishor@mnnit.ac.in
Total Cost:	68 Lacs (MNNIT: 54 Lacs, IIT Kanpur: 14 Lacs)
Duration:	3 Years, (Sanctioned: March 2020)

***Project Description*:**

Operation of the power systems is more and more enabled by phasor measurement units (PMUs) providing a wealth of data and controlled by disparate systems.Advancements in remote signal measurement via PMUs have dramatically increased the availability of transient events for analysis. An accurate algorithm on event diagnosis can help to interpret amount of control action required in real-time. Tremendous threats arise from the attacker's ability to launch intrigue, remote, simultaneous, and/or coordinated attacks from the cyberspace. The attack schemes can be on generation, transmission, distribution, electricity markets, etc.

The research objectives are framed in the lines of above challenges. This is a collaborative project with Prof. SaikatChakrabarti, IIT Kanpur.

Research Project Topic:	Developing a Model for Effective Adoption of Solar Energy System
Funding agency:	ICSSR under IMPRESS Scheme
Name of Faculty member:	Prof.*G. P. Sahu, SMS*
Name of the School:	School of Management Studies
Faculty member email ID:	gsahu@mnnit.ac.in
Total Cost:	15 Lacs

***Coverage*:**

Selected states of North India would be taken as sample area of the study, in which districts will be selected on the basis of classification approach for the data collection. The Model proposed to be developed under this study will support in focusing on select Critical Success Factors for effective implementation/adoption of solar Energy system.

Research Project Topic:	Mapping Groundwater Quality Depleted Area, Potential Groundwater Recharge Zones and Evolving the Farmer's need based Groundwater Recharge Structures in District Mahoba of Bundelkhand Region of UP
Funding agency:	*DST, New Delhi*
Name of Faculty member:	Dr. Hemant Kumar Pandey (PI), Dr. PramodSoni (Co-PI)
Name of the Department:	Civil Engineering
Faculty member email ID:	pandey_hk@rediffmail.com
Total Cost:	14.99Lacs

Recent Events

Title of activity: INGSA Asia Grassroots Science Advice on Nutrition and Health (India) (ISANH-2019)

Date: 17-18 December 2019

Organizing Department: Biotechnology

Activity type: Workshop

***Short description about activity*:**

The International Network war organised the Department of Biotechnology had organised the INGSA Asia Grassroots Science Advice on Nutrition and Health Workshop on 17-18 December, 2019 at the MNNIT Allahabad.

Title of activity: Food and Health Biotechnology Solutions to Life: An Improved Way to Living (FHBS- 2019).

Date: 20-26 December, 2019

Organizing Department: Biotechnology

Activity type: Short term course

Short description about activity: This seven days short term course was organized in Department of Biotechnology, MNNIT Allahabad. In this course, various food borne diseases and their prevention by using biotechnology was discussed and hands on training were given.

Title of activity: **AICTE Training And Learning (ATAL) Programme On Artificial Intelligence**

Date: April 27- May 01, 2020, May 04-08, 2020, May 11-15, 2020, May 18-22, 2020

Organizing Department: School of Management Studies

Activity type: Faculty Development Programme

Short description about activity: The main objective of the AICTE Training And Learning (ATAL) Programme On ARTIFICIAL INTELLIGENCE (AI) was to make the participants familiar with the concept of AI, history, current status, scope, agents and environments. It also aimed at learning various tools and techniques used in Artificial Intelligence. The faculty members of the AICTE approved institutions, research scholars, PG Scholars, participants from Government and Industry including Bureaucrats/Technicians/Participants etc. were invited to participate in the programme.

Title of activity: Thoughts on Public Finance, Trade & Technology during COVID-19 Pandemic.

Date: **July 04, 2020**

Organizing Department: **School of Management Studies**

Activity type: **Webinar**

***Short description about activity*:** The distinguished speaker for the webinar is Mr. Dhananjay Singh (IRS, Ministry of Finance Govt. of India).

Title of activity: **Data Analytics and its Applications in Management (STTP-DAAM)**

Date: February 04-08, 2020

Organizing Department: School of Management Studies

Activity type: Short Term Training Programme

***Short description about activity*:** The main objective of the programme was to make the participants familiar with the various data mining/data analytics tools and its implications in different domains of management.

Non Exclusive Technology Transfer and Licensing Agreement

MNNIT Allahabad signed its first "non-exclusive technology transfer and licensing agreement" with GARG Telecom Corpotation for manufacturing and commercialization of Viralyser, a portable, low cost, UV sanitization device for home and office use. Prof Rajeev Tripathi, Director MNNIT mentioned that the agreement will help in enhancing culture of innovation and startup in the Institute and help in commercialization of the product. This agreement has also strengthened the role of MNNIT in development of its Industrial Estate.

Dr.Sarvesh Kr. Tiwari, Registrar MNNIT Allahabad signed the Memorandum of Understanding (MoU) with Garg Telecom Corporation, Allahabad, in the presence of Prof. Rajeev Tripathi, Director MNNIT Allahabad, Prof. Geetika (Chairperson IPR and Dean Research & Consultancy), Sri Ravi Agarwal and team members.

Major orders for supply of the Viralyser have been received from Allahabad High Court and Accountant General Office, Uttar Pradesh.

The project on Viralyser: a UV-C sanitization device was initiated under Design Innovation project sponsored by Ministry of Human Resource Development (MHRD) by team comprising of Dr. Sameer Srivastava, Dr.Ambak K. Rai, Dr.Ashutosh Mani, Dr. N.K. Singh, Prof. Shivesh Sharma and Prof. Rajeev Tripathi.

Non Exclusive Technology Transfer and Licensing Agreement