الـجامـعـة الوطنيـة
National University
Science & Technology للعلـوم والتكنـولوجيا

NU Core Research Areas & Groups

Approved by URIC on 20th April 2021

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COLLEGE OF ENGINEERING

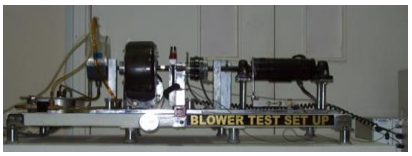
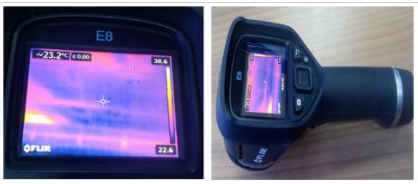
COLLEGE OF ENGINEERING - CORE RESEARCH AREAS & GROUPS

Core Research Area	1 System Reliability, Availability & Maintainability	
About the Research	**System Reliability, Availability & Maintainability** is one of the areas commonly used in **analyzing complex industrial systems.** It is important **to track the complex system behavior over time so that the best preventive and corrective maintenance practices could be deployed**, and the system's premature failure could be avoided. The objective is to form the basis for the system operational capability studies & cost-benefit analysis of the system. Developing robust models for the system under different operating conditions opens up the scope for a good comparison study among the models about their suitability to meet the expectations. **The research group has worked on major projects in the renewable energy & water desalination area where the design of data collection, development of the model for system analysis, and its validation were carried out**. The group has worked for CC Plant, cable industry, desalination plant, aluminum industry and developed robust models for the system analysis. **Our key research covers:** Design of data collection, **development of models for system analysis**, applying optimization techniques, and its validation.	
People	**Lead:** Prof Syed Mohd Rizwan  Email: syedrizwan@nu.edu.om Mobile: 99536593 Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf	**Team:** 1. Prof K P Ramachandran 2. Dr Padmavathi N 3. Dr Yaqoob Mubarak 4. Dr Senguttuvan 5. Syed Taj 6. Ms Nabila Al Balushi
Projects & achievement	**PhDs completed**: 04 (Stochastic Models in Reliability) **Projects Completed/Ongoing**: 04 1. Reliability Modeling and Analysis of Desalination Plant 2. Reliability and Availability Analysis of PLC Systems at Salalah Port 3. Renewable Energy Production from Anaerobic Co-digestion of Fruit and Vegetable Waste together with Oil and Fatty Residue (**Optimization of operating parameters through modeling**)	

	4. Development of Noble Membrane Biofilm Fuel Cell for Simultaneous Oilfield Water Treatment and Electricity Generation (**Optimization of operating parameters through modeling**)
Recently featured publications	**Number of Publications:** More than 100 Publications/Presentations in Journals/Conferences Some of the cited Publications as as under: 1. Mathew, AG, Rizwan, S M, Majumder, MC & Ramachandran, KP 'Reliability modeling and analysis of a two unit continuous casting plant' **Journal of the Franklin Institute**, 348, 2011, pp. 1488 -1505. doi:10.1016/j.jfranklin.2010.04.016 (**SCOPUS).** 2. Rizwan SM, Vipin Khurana and Gulshan Taneja, "Reliability Analysis of a hot standby industrial system" **International Journal of Modeling and Simulation**, Vol. 30, No. 3, 2010, pp. 315-322. Taylor & Francis; (**SCOPUS).** 3. Rizwan SM, Joseph V Thanikal and Michel Torrijos 'A general model for reliability analysis of a domestic waste water treatment plant' **International Journal of Condition Monitoring and Diagnostic Engineering Management**, Vol. 17, No. 3, July 2014, pp. 3-6. (**SCOPUS**). 4. Rizwan SM, Padmavathi N, Anita Pal, G Taneja 'Reliability Analysis of a Seven Unit Desalination Plant With Shutdown During Winter Season and Repair / Maintenance on FCFS Basis' **International Journal of Performability Engineering**, Vol. 9, No. 5, Sep 2013, pp. 523-528. (**SCOPUS).** 5. Yaqoob Al Rahbi, Rizwan SM, Babakalli Alkali, Andrew Cowel and Gulshan Taneja, "Maintenance Analysis of a Butt Thimble Removal Station in Aluminum Plant" **International Journal of Mechanical Engineering and Technology**, Vol. 9, Issue 4, Apr 2018, pp. 695-703. (**SCOPUS**) Impact Factor 2016: 9.2286. 6. Syed Zegham Taj, Rizwan SM, Babakalli Alkali, David Harrison and Gulshan Taneja, "Performance Analysis of a Rod Breakdown System", **International Journal of Engineering and Technology** (UAE), Vol. 7, issue 3.4, pp. 243-248, 2018 (**SCOPUS**). 7. Yaqoob Al Rahbi, Rizwan SM, Babakalli Alkali, Andrew Cowel and Gulshan Taneja, "Reliability Analysis of Multiple Units with Multiple Repairmen of Rodding Anode Plant in Aluminium Industry", **Advances and Applications in Statistics**, Vol. 54, No. 1, Jan 2019, pp 151-178. (**Web of Science).** 8. Yaqoob Al Rahbi, Rizwan SM, Babakalli Alkali, Andrew Cowel and Gulshan Taneja, "Reliability Analysis of a Rodding Anode Plant in Aluminum Industry with Multiple Units Failure and Single Repairman", **International Journal of System Assurance Engineering and Management**, DOI https://doi.org/10.1007/s13198-019-00771-3, 2019, Springer (**SCOPUS and Web of Science).** 9. Syed Zegham Taj, Rizwan SM, Babakalli Alkali, David Harrison and Gulshan Taneja, "Profit analysis of a cable manufacturing plant portraying the winter operating strategy" **International Journal of Mechanical Engineering and Technology**, Vol. 9, issue 11, 2018, pp. 370–381. (**SCOPUS**) Impact Factor 2016: 9.2286. 10. Syed Zegham Taj, Rizwan SM, Babakalli Alkali, David Harrison and Gulshan Taneja, "Three Reliability Models of a Building Cable Manufacturing Plant: A comparative Analysis" **International Journal of System Assurance Engineering and Management**, DOI https://doi.org/10.1007/s13198-020-01012-8, 2020, (**SCOPUS and Web of Science)**.

Core Research Area	2 Intelligent Maintenance Monitoring & Instrumentation	
About the Research	**Focus:** Condition-based maintenance, Automatic Fault Diagnosis, Functional failure, process instrumentation, and Maintenance management. **Scope:** Process equipment maintenance, Instrumentation and Control for Performance Optimization of Multi-Scale Systems, and condition monitoring, application and development of engineering technologies Signal processing, AI, and Machine learning applications to meet the industrial needs. Condition monitoring and maintenance management are the strongest areas of research expertise available in the University, having success in working with leading international partners. Machine condition monitoring provides safe and reliable operation of various forms of equipment. The acoustic or vibration/oil or PD signal emerging from operating machines can indicate machine fault at an early stage to know exact maintenance action. Our instrumentation and signal processing systems integrated with Modeling and Artificial intelligence applications provide an accurate health prediction of critical systems like pumps, turbines, engines, transformers, and electrical motors, etc. This multidisciplinary research group has the competence and experience in supporting the development of Instrumentation and Control Technology and Science in the scope of research in various fields of application. The group's expertise lies primarily in-process sensors, intelligent instrumentation, embedded systems, smart condition monitoring, digital image processing, data fusion, data modeling, and robust control and estimation. Our key research covers: Automated mechanical and electrical fault diagnosis, instrumentation, signal processing, AI and Machine learning applications, Oil analysis and NDT applications, Maintenance modeling, and optimization.	
Alignment with Oman Vision 2040	Achieving advanced and automatic maintenance and condition monitoring for the machines in industries through the utilization of the new smart technologies like artificial intelligence and the internet of things	
People	**Lead:** Prof K P Ramachandran College of Engineering 	**Team:** 1) Dr Moammer Ali Saud AL Tobi 2) Dr G R Ramesh Kumar 3) Prof Sudhir CV 4) Dr Suresh Manick 5) Mr Rene P 6) Laboratory Instructors & Research Assistants

	Email: ramachandrankp@nu.edu.om Mobile : +968 -92111740 Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf	
Projects & achievement	• Reliability & Availability analysis and maintenance inspection models for PLC systems (Salalah port) • Intelligent diagnostic maintenance system for process machines (TRC Research grant)	
Recently featured publications	**The research group has produced more than 8 PhDs, 20 Masters dissertations, and 40 publications in peer-reviewed journals over the last 8 years in the relevant areas. The recently featured publications include:** 1. **M. A. S. ALTobi**, G. Bevan, P. Wallace et al., (2019). Fault diagnosis of a centrifugal pump using MLP-GABP and SVM with CWT, Engineering Science and Technology, an International Journal, Elsevier, Vol. 22 (3), pp. 854-861 https://doi.org/10.1016/j.jestch.2019.01.005. 2. ALTobi M.A.S., Bevan G., Wallace P., Harrison D., Ramachandran K.P. (2019) Centrifugal Pump Condition Monitoring and Diagnosis Using Frequency Domain Analysis. In: Fernandez Del Rincon A., Viadero Rueda F., Chaari F., Zimroz R., Haddar M. (eds) Advances in Condition Monitoring of Machinery in Non-Stationary Operations. CMMNO 2018. Applied Condition Monitoring, Vol 15. Springer, Cham. 3. Al Tobi M, Bevan G, Wallace P, Harrison D, Okedu KE. Faults diagnosis of a centrifugal pump using multilayer perceptron genetic algorithm back propagation and support vector machine with discrete wavelet transform-based feature extraction. Computational Intelligence. 2020; 1–26. https://doi.org/10.1111/coin.12390. 4. Salim R.K and **G.R. Rameshkumar** (January 2016) Optimization of Overall Equipment Effectiveness Through Total Productive Maintenance Perspective - A Case Study, *International Journal of Multidisciplinary Sciences and Engineering,* Vol. 7, No.1, pp. 1-7. 5. Sulaiman Khalifa Saif Al Adawi and **G.R. Rameshkumar** (January 2016) Vibration Diagnosis Approach for Industrial Gas Turbine and Failure Analysis, *British Journal of Applied Science and Technology,* Vol. 14, No.2, pp. 01-09. 6. M . Lokesha, M.C.Majumdar, K. P. Ramachandran(2015), Fault detection and diagnosis in gears using wavelet analysis techniques and comparison on their diagnostic capability; Transactions of Technical publications(Switzerland), Applied mechanics and materials, Vols 789-790,pp 587-591 7. Abdulrahman Abdulshakoor Al Bulushi, **G.R. Rameshkumar** and M. Lokesha (November 2015) Fault Diagnosis in Belts using Time and Frequency based Signal Processing Techniques, *International Journal of Multidisciplinary Sciences and Engineering,* Vol. 6, No.11, pp. 12-20.	
Resources /lab facilities	The research work we undertake is mainly focused on creating artificial faults, collecting the signal using sensors, and interfacing with data analyzer and PCs. We are equipped with a variety of instruments including	

	• Vibration Sensors and Analyzers • Sound Level Meter • Machinery Fault Simulator • Centrifugal Blower test rig • NI DAQ system with LabVIEW software • Oil analyser • Thermography Camera • ICPER and Gas chromatography	 Vibrotest 60 data collector with accelerometer  Centrifugal Blower test rig  The Machinery Fault Simulator  NI DAQ system with LabVIEW software  Thermography Camera
News & events/training	The group engaged in many scholarly activities and conducted professional training courses to industries, 1. Engineering Management Training program for Royal Navy of Oman, 13.12.2020 to 29.12.2020. 2. Intermediate Engineering Training program for Royal Navy of Oman, 12.01.2021 to 28.01.2021. 3. Maintenance management for RCA 4. Organized national level conference on Maintenance Management	

Core Research Area	3 Sustainable Energy Conversion Technologies and Management (SECTM)	
About the Research	**Focus:** Clean Energy, Thermal Systems and Renewable Energy, Smart grid technologies, and Energy Audit and management. **Scope:** Develop and apply appropriate energy conversion techniques and their applications for new environmentally friendly and sustainable sources of green energy. Production of biohydrogen and hydrogen gas from a renewable and sustainable source of energy Energy Conversion Technologies and Management is one of the strongest areas of research expertise available in the university, with prove track record of successfully involved in securing research projects and collaborating with erudite professionals of international repute. The scope of this group is also included augmentation and integration of Wind Farms into Power Systems, Grid Frequency Dynamics, Hybrid Renewable Energy System Penetration (Standalone) and Grid-Connected System (non-Autonomous), Smart grid technologies, FACTS devices, and power electronics, Future Energy Storage System (Hydrogen Gas Production) and Fuel Cells Applications. Applications of Power Electronics Technology in Power Systems. This multidisciplinary research group strives to support the United Nations Sustainable Development Goals (SDGs) with fundamental and applied research across Smart grid technologies, FACTS devices and power electronics, Clean Energy, Thermal system, Energy conversions, and its management. The studies will cover energy and exergy analysis to determine the thermodynamic potential for improvement. The research group is involved in multidisciplinary research leveraging strong ties with local universities. The Group will contribute to identifying technologies that can reduce energy consummation through systematic energy management strategies. We focus on a diverse portfolio of advanced energy conversion technologies intending to provide the tools necessary to create and sustain a clean energy system. We have active collaborations with industry, academia, and other National Laboratories	
Alignment with Oman Vision 2040	In line with the Oman National priorities viz. Natural Resources and Environmental Sustainability. Which emphasis on application of conserving techniques and renewable energy sources for reduced energy consumption.	
People	Lead: Prof. Sudhir C V	Team: 1. Dr Tanavade Satish 2. Dr. M. Achuthan 3. Dr Pawar Dharmasa 4. Dr.K.M.Abubacker 5. Dr. Parimal Sharad Bhambare 6. Dr. Dinesh Keloth Kaithari

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7. Mr. Fasil Gessesew Beyene
8. Mr. Mohammed Kunhamu
9. Laboratory Instructors & Research Assistants

Projects & achievement

Completed projects:

Sl. No	Project title	Research Team	Funding Agency
1	Standalone Solar Photovoltaic water cooler	Prof K P Ramachandran (PI), Prof. Feroz S (Co-Investigator);	IIC
2	Water From Air	Dr. K.M. Abubacker (PI) Dr. R. Senthilkumar (Co-Investigator)	IIC
3	Application of Solar Nano-Photo Catalysis in Reverse Osmosis Pre-treatment Process	Prof. S. Feroz (PI)	TRC

4	Design and Development of Desalination Flash Chamber for Integrating IT with Concentrated Type Solar Collectors	Dr. V. Sudhir (PI), Dr. Ravinder Kumar, Prof.S Feroz, Dr. Parimal Bhambare, Mr Varghese. Mr Salim RK	TRC
5	Design and Fabrication of Solar Cabinet Dryer and Kinetic modeling studies for drying Performance enhancement	Ms. Josephine Selvi (Mentor)	TRC
6	Development of solar basin desalination for domestic utilization	Ms. Shamsa AlSadi / Mr Shabib Sulaiman Ali Al Rashdi (Mentor)	TRC
7	Renewable Energy Production from Seawater, Squid Bone and Industrial Aluminum Scraps	Varghese.M.J (Mentor)	TRC
8	Design and Development of eco friendly Solar Dryer for Cottage Industries in Oman	Dr Achuthan (mentor) 1.	TRC

Ongoing Project(s)

Sl. No	Project title	Research Team	Funding Agency
1	Solar distillation unit for the processing of medicinal and aromatic plants in Oman	Dr. Parimal Sharad Bhambare Co-PI: Prof. Sudhir C. V.	TRC
2	Intelligent Solar Operated Air-conditioning and Water Extraction System from Air for Oman Climate Conditions	Dr Achuthan (mentor)	TRC
3	Energy Audit at NU campus	Dr. V. Sudhir Dr Achuthan Dr. Dharmasa	NU

Recently featured publications	Papers: 1. Parimal S. Bhambare, Dinesh K. Kaithari, Said Abdullah Rashid AI Hosni. 2021. Performance enhancement of a Single Slope Solar Still (SSSS) with single basin using Fresnel lens, Journal of Mechanical Engineering Sciences (JMES), in printing. Scopus and Web of science indexed journal. 2. Maryam Al Baloushi, Parimal Bhambare, Rupesh Yadav, M. Achuthan, Santosh Walke, 2021, Experimental study on direct, indirect and open air drying of Kiwifruits using a hybrid cabinet type solar dryer, Solid State Technology, Vol. 63, Issue 5, pp. 7708-7715. Scopus indexed journal. 3. Uhunmwangho R., Emu C. and Okedu K. E. 2021. Assessment of Economic Viability of Wind Power Plant in Bonny Island of Rivers State of Southern Nigeria for Cleaner Electricity Generation, International Journal of Engineering Research in Africa (JERA), vol. 53, no 3. pp. 157-170 (SCOPUS) 4. Okedu K. E., Barghash H. 2021. Enhanced Dynamic Behaviour of Grid Connected Wind Farms in Load Participation and Frequency Regulation, Frontiers in Energy Research-Smart Grids, vol. 8, pp. 1-12, Article 606019 (SCOPUS) 5. Okedu K. E., Barghash H. 2021. Enhancing the Performance of DFIG Wind Turbines Considering Excitation Parameters of the Insulated Gate Bipolar Transistors and a New PLL Scheme, Frontiers in Energy Research-Smart Grids, vol. 8, pp. 1-14, Article 620277 (SCOPUS) 6. Okedu K. E, Barghash H. 2021. Investigating Variable Speed Wind Turbine Transient Performance Considering Different Inverter Schemes and SDBR, Frontiers in Energy Research-Smart Grids, vol. 8, pp. 1-16, Article 604338 (SCOPUS) 7. Parimal Bhambare, 2020, A Solar Parabolic Trough Concentrator (PTC) Model using MATLAB SIMULINK, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Vol. 10, Special Issue, pp. 413-423. Scopus indexed journal. 8. Abdalla Ayoub Abdalla, Parimal Bhambare, Ganesh Patil, Santosh Walke, 2020, Frankincense oil extraction using steam distillation, hydro distillation and solvent extraction methods: a comparison, International Conference on Energy and Environment Technologies for Sustainable Development (Chem-Conflux), MNNIT, Allahabad, India, 14-16, February, 2020. 9. Talal Mohammed Al Hoqani, Parimal S. Bhambare, Dinesh K. Kaithari, "Solar Thermal Energy Utilization using Metal Fiber Reinforced Concrete (MFRC) Collector for Producing Hot Water in Sultanate of Oman", International Journal of Innovative Technology and Exploring Engineering (IJITEE), Vol. 8, Issue 11, 1335 - 1340, 2019, Scopus indexed journal. 10. Rees Alexa Robert, Dinesh Keloth Kaithari, M. Mumtaz Mirza, Parimal Sharad Bhambare. 2018. Influence of nano Al2O3 to improve the yield of double slope solar still", International Journal of Students, Research in Technology & Management, Vol. 6, No.3, pp. 1-18. 11. Parimal Bhambare, Manik Majumder, Sudhir C. V., 2018, Solar Thermal Desalination: A Sustainable Alternative for Sultanate of Oman, International Journal of Renewable Energy Research (IJRER), Vol.2 (8), 733-751, 2018. Scopus,

Web of science and SCI indexed journal. Available from: http://ijrer.org/ijrer/index.php/ijrer/article/view/7209.

12. Parimal Bhambare, Manik Majumder, Sudhir C. V., 2018, Decentralized standalone Multi Effect Desalination (MED) system using fixed focus type Scheffler concentrator for the remote and arid rural regions of Sultanate of Oman, IOP Conf. Series: Materials Science and Engineering, Vol. 376 (2018), 012006, doi:10.1088/1757-899X/376/1/012048. Available from: http://iopscience.iop.org/article/10.1088/1757-899X/376/1/012006/pdf. Scopus indexed proceedings.
13. Shetha Daniel1, Manik C Majumder and CV Sudhir., 2018, Performance Evaluation of Nano Additives and Surfactants on the properties of Electroless Nickel Phosphorous Coating on Aluminium – Magnesium Alloy, IOP Conf. Series: Materials Science and Engineering, Vol. 376 (2018), 012006, doi:10.1088/1757-899X/376/1/012006. Available from: https://iopscience.iop.org/article/10.1088/1757-899X/376/1/012048. Scopus indexed proceedings.
14. Parimal Bhambare, Manik Majumder, Sudhir C. V., 2018, Brine heat recovery unit for Multi Effect Desalination (MED) system based on Scheffler Concentrator using shell and coil heat exchanger, IOP Conf. Series: Materials Science and Engineering, Vol. 376 (2018), 012009, doi: doi:10.1088/1757-899X/376/1/012009. Available from: http://iopscience.iop.org/article/10.1088/1757-899X/376/1/012009/pdf. Scopus indexed proceedings.
15. Salim R K and Sudhir C V, (2017). Energy Audit for an Educational building which operate in Middle East Climatic Conditions. International Journal of Advanced Engineering Research and Science , ISSN: 2349-6495(P) 2456-1908. Volume- 4, Issue-4 ,pp.42-48.
16. C V Sudhir, S Feroz ,(2016) "Potential Of 16 M2 Solar Scheffler Reflectors For Thermal Applications –Experimental Investigation". Journal of Advances in Science Engineering and Technology, ISSN: 2321-9009. Volume- 4, Issue-2,pp.42-46.
17. Rees Alexa Robert, Dinesh Keloth Kaithari, M. Mumtaz Mirza, Parimal Sharad Bhambare, (2018): Influence of nano Al2O3 to improve the yield of double slope solar still, International Journal of Student's Research in Technology and Management, Vol.6, Issue-3: 01-08.
18. Okedu K. E., published a book entitled Enhanced Power Grid Stability Using Doubly-Fed Induction Generator, by American Institute of Physics Publishers (AIPP), 2020. AIP Publishing LLC AIP Publishing Melville, New York.

Resources /lab facilities	Solar Thermal concentrator and custom-built flash chamber, condenser and heat recovery exchangers, and mountings	
	3 KWp On Grid Solar PV system with inverter and associated facilities	
	All in One-Portable Weather Station with Solar pyranometer Meter, wind sensor and data logging and portable data station	
	Thermal Imaging camera, Solar pyranometer,	
News & events/training	Give any conference or workshop or training /scholarly activities related to the research INTERMEDIATE ENGINEERING TRAINING PROGRAM for Royal Navy of Oman from 12th January 2021 to 28th January 2021.	

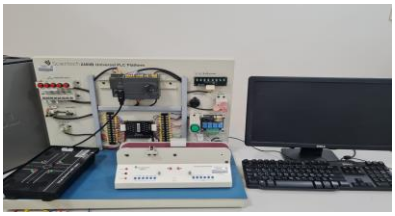
Core Research Area	4 Automation, Robotics & Manufacturing (ARM)
About the Research	Design, manufacturing, Mechatronics, Automation, and Robotics are the important research areas in Industry 4.0 in which many staff and students of NUS are doing research already. Industry 4.0 focuses on modern technologies like additive manufacturing, 3D and 4D printing, Robotics, Artificial Intelligence, IoT technologies etc. These technologies are the current trend in the ongoing automation of traditional manufacturing and industrial practices, using smart technology. Design, manufacturing, mechatronics, and robotic Engineers' role and responsibilities are very crucial in the current and future Industrial revolution to change the world. Many universities are having research groups that are doing researches in the industry 4.0 technologies. So, a research group is formed with the faculties who have expertise in the modern manufacturing area to enhance the research work in our NUST campus. **Our key research covers:** CAD/CAM. 3D printing, 4D printing, Modern Manufacturing techniques, Mechatronics System Design, Robotics, Automation, Artificial Intelligence in Manufacturing, IoT technologies in Manufacturing and Process Industries.

People	**Lead: 1-**	**Team:**
	 **Dr.R.Amuthakkannan** **Email: amuthakkannan@nu.edu.om** **Mobile : 98893272** **Link: https://www.nu.edu.om/res**	10. Dr. R. Amuthakannan 11. Dr K.Suresh Manic 12. Dr. Suresh babu 13. Dr. Dinesh Keloth Kaithari 14. Dr. Haris Kadir Mohammed 15. Dr. K.M.Abubacker 16. Dr. Pradeep Kumar Krishnan 17. Dr Satish Tanavade 18. Dr Feras Al Attar 19. Mr. T. A. Sulaiman 20. Mr. Motilal Lakavat 21. Ms. Shetha Daneil 22. Mr. Fasil Gessesew Beyene 23. Mr. Rene Sinogaya Pacturan 24. Mr D.Ragavesh 25. Mr Imad Saud Al Naimi 26. Mr. Bader Al Meshaifry 27. Mr. Said Hamed Rashid Al Oraimi 28. Ms. Jawaher Al yarubi 29. Ms.Raiya Al Hajiri

	earch/docs/ResearchFaculty Profile-CoE.pdf **2- Dr K.Suresh Manic College of Engineering**  Email: sureshmanic@nu.edu.om Mobile : +96891990856 Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf	
Projects & achievement	➢ Water from Air (IIC Research Grant) ➢ Design and Development of a Portable Crusher Grinding Machine for Marble and Granite Waste. (IIC Research Grant) ➢ Development of a National Standardization Policy for Omani Manufactured Water Coolers & Air Conditioners (Split Units) (IIC Research Grant) ➢ Standalone Solar Photovoltaic water cooler (IIC Research Grant) ➢ Critical study and analysis of existing production lines for enhancement of productivity and efficiency in NCPI- LLC(IIC Research Grant) ➢ Development of Solar Cooking System and Its performance and suitability analysis for Oman domestic application (TRC Funded Research) ➢ Development of solar basin desalination for domestic utilization (TRC Funded Research) ➢ Design and Development of ecofriendly Solar Dryer for Cottage Industries in Oman(TRC Funded Research) ➢ Autonomous Robotic Mapping and Navigation in Mining Industry using Machine Learning (TRC Funded Research) ➢ Intelligent Solar Operated Air-conditioning and Water Extraction System from Air for Oman Climate Conditions (TRC Funded Research) ➢ Autonomous Mobile Robot for Offshore Rig Operations using Machine Learning (NU Funded Research) ➢ Received Patent on “An Automatic date fruit harvesting robot using image processing”. ➢ Received Patent on ‘A Prototype Device for Generation of Electricity Using Wind Turbine’. ➢ An Automatic robot for date fruit harvesting (NUFRG project funding). ➢ Completed One PHD student on research title “Sliding mode control for Nonlinear systems” 2018	

Recently featured publications	The research group has produced 4 PhDs, 10 Masters dissertations, and 50+ publications in peer-reviewed journals over the last 8 years in the relevant areas. The recently featured publications include: • Amuthakkannan R (2014), Parameter design of an electro-pneumatic system using response surface methodology' Int. Journal of Engineering Science and Technology (IJEST), Vol. 6 No.10 Oct 2014,pp 661-669. • V Saravanan, S Rajakumar, N Banerjee, R Amuthakkannan(2016) Effect of shoulder diameter to pin diameter ratio on microstructure and mechanical properties of dissimilar friction stir welded AA2024-T6 and AA7075-T6 aluminum alloy joints, The International Journal of Advanced Manufacturing Technology, Vol.87, Issue 9-12, pp. 3637-3645, Springer London. • Amuthakkannan R., Abubacker KM., Suresh Babu,V (2018), "Improvement of QFD effectiveness with blend of voice of customer and red green chart on complex mechatronics products, World Journal of Engineering Research and Technology, WJERT, 2018, Vol. 4, Issue 1, 437-451. • Suresh Babu V & Abubacker K M, Development of Involute Profiled Spur Gear Model with Excel Spread sheet, Solidworks and CAD Technique, SSRG International Journal of Mechanical Engineering, Vol. 5, No. 5, May 2018, pp.5-11. • Suresh Babu V, Majumder M C & Ramprasad A, Involute Tooth Spacing, Gear Profile and 3D Gear development with MATLAB Graphical User Interface and Solidworks, International Journal of Industrial Engineering, Vol. 2, No. 3, March 2018, pp. 67-75. • Suresh Babu V, Majumder M C & Ramprasad A, Investigation and Development of Non-Symmetric Gear System with Matlab Graphical User Interface and Autodesk Inventor, International Journal of Industrial Engineering, Vol 1, No. 5, August 2017, pp. 151-160. • P. Kumar, J. Victor, R. Arunachalam, A. I. Mourad, R. Muraliraja, M. Al-maharbi, V. Murali, and M. Manik, (2019): Production of aluminium alloy-based metal matrix composites using scrap aluminium alloy and waste materials: Influence on microstructure and mechanical properties, Elsevier Editorial System (tm) for Jornal of Alloys and Compounds. • Krishnan, P., Arunachalam, R., Husain, A., Al-Maharbi, M., 2020. Studies on the Influence of Stirrer Blade Design on the Microstructure and Mechanical Properties of a Novel Aluminium Metal Matrix Composite. J. Manuf. Sci. Eng. 1–25. https://doi.org/10.1115/1.4048266 • R.Arunachalam, P. Kumar, and R. Muraliraja, (2019): A review on the production of metal matrix composites through stir casting: Furnace design, properties, challenges, and research opportunities, Elsevier Editorial System (tm) for Journal of Manufacturing Processes, vol. 42, no. December 2018, pp. 213-245, 2019. • R. Arunachalam, S. Piya, P. K. Krishnan, R. Muraliraja, J. V. Christy, and A. I. Mourad,(2019): Optimization of a stir, squeeze casting parameters for production of metal matrix composites using a hybrid analytical hierarchy process, Taguchi-Grey approach, Eng. Optim., vol. 0273, no. 15X, pp. 1-19, 2019. • K Suresh Manic, V. Rajinikanth, S.Uma, Sarath Ananthasivam. "Design of Controller in double feedback control loop –An analysis with heuristic algorithms" Chemical Product and Process Modeling Journal, De Gruyter publications Volume 10, issue 4 pp 253-262,ISSN 1934-2659 December 2015.(WOS)

	• B. Senthil Kumar, K.Suresh Manic " Sliding Mode control of a rotary inverted pendulum" International Journal of Applied Engineering Research- Research India Publications, ISSN 0973-4562, 10(66) September 2015 pp 14-18(SCOPUS) • Suresh Manic.K, S.Devakumar, V.Vijayan and Rajinikanth.V " Design of centralized PI controller for Interacting Conical System" Indian Journal of Science and Technology, ISSN 0974-6846, Vol 9(12) March 2016.(scopus) • Suresh Manic.K, Uma Suresh, R.Senthil "Design of Multi-loop PI controllers for TITO systems using TLBO Algorithm" Australian Journal of Basic and Applied Science- AENSI Journals ISSN 1991-8178, 10(5) March 2016 pp 111-116. • Anusha Rani, Senthil Kumar B, K.Suresh Manic, "Sliding Mode Control for robust regulation for chemical Processes" Indian Journal of Science and Technology, ISSN 0974-6846, Vol 9(12) March 2016(scopus) • Senthil Kumar B, K.Suresh Manic, " sliding mode control for robust tracking of a first order system with time delay" International journal of Advanced Engineering Technology, E-ISSN 0976-3945, Vol 7(1), March2016, pp761-764. • Senthil Kumar B, K.Suresh Manic, "Optimal sliding surface design for a MIMO distillation system" Rev. Tec. Ing. Univ. Zulia., doi:10.21311/001.39.8.03, Vol 39(8), November 2016, pp21-26, (IF-SCOPUS) • Basma Al-Subhi, Feras N.Hasoon, Hilal A.Fadhil, Suresh manic and Roshima Biju "Smart vehicle headlights control system", proceedings of the International Engineering conference -12th EURECA 2019, Published by AIP Publishing, AIP conference proceedings 2137, 030001 (2019 Aug), pp 030001-8. (SCOPUS). • Satish Tanavade, K. Suresh Manic, "Design Optimization for Modified Series-Parallel Resonant Converter", Journal of Computational and Theoretical Nanoscience, ISSN 1546-1955, Vol. 17, Number 4, pp 1710–1714 (2020)(SCOPUS) • S. S. Tanavade, S. Premachandran, 'State Space Modeling and Simulation for LCC type Resonant Converter', International Journal of Research and Innovation in Applied Science, Volume III, Issue II, February 2018, ISSN 2464-6194. • Pritam Keshavdas Gujarathi, Satish Tanavade, Varsha A. Shah, Makarand M. Lokhande, 'Single Converter Topology for Converted Plug-In Hybrid Electric Vehicle', International Journal of Applied Scientific and Engineering and Management, volume 4, issue 02, March 2018 ISSN: 2454-9940.	
Resources /lab facilities	The research work we undertake is mainly focused on design, manufacturing, Automation and Robotics • CAD/CAM Lab Various Design software, 3D Printer, CNC Machines etc) • Automation Lab (Robots, PLC, Lab VIEW software and Data acquisition	 CNC machines in CAD/CAM Lab 

	hardware, Engraving machine) • Mechatronics and control Lab (Pneumatics, MATLAB software sensors, transducers and actuators) • Workshop (General workshop facilities for machining purpose)	Sensor and Transducer Trainer  3 D Printer  Robot in automation lab  PLC Trainer with ladder software  Lab view Software
News & events/training (if any)	The group engaged in many scholarly activities and conducted symposiums, workshops and training programs, and also the group members delivered many guest lectures in different research areas. Recent/forthcoming activities: Conducted National level Symposium on challenges in Fourth Industrial Revolution during Nov 2019. Given training in Lab VIEW Software to teachers and students through professional chapters. An international symposium on Challenges in the Fourth Industrial Revolution will be held on April 28, 2021. Conducted a national-level workshop on “PLC Automation in real-time experience”. Organised a seminar "Live Demo on Industrial Automation" with Technocrat automation solutions pvt ltd. Attended three-day intensive and practical course (ABB certified course) on “ Basic Operation and Programming of IRC5 Robot” by ABB. Conducted ABB workshop on operating IRC5 Robot

Core Research Area	5 Novel Materials & Nanotechnology (NMN)
About the Research	Nanotechnology & the development of novel materials for the Circular Economy are the significant areas of research expertise available in the University with many facilities and proven records. The focus is on the nanostructured materials with fundamental application of nanoparticles and Nano thin films technology in the Biomedical and environmental, wastewater treatment and corrosion. The scope of the project is to develop and apply nanotechnology innovations through transforming laboratory research into industrial-scale development of new products by innovative techniques through novel materials from Plant/crop-based renewable resources, Biomaterials, Polymers, Photocatalysis, Corrosion inhibitors for Industrial effluent treatments, waste management, eliminating waste and the continual use of resources in order to give emphasis to economical and sustainable solutions. In addition, this research group focuses on wastewater treatment and corrosion with the applications of Nanotechnology and novel materials. The Scarcity of water and the need for protecting the health of ecosystems and people is the driving force to pursue research in the area of wastewater treatment and corrosion. Effective technological methods need to be developed led to reuse treated wastewater thereby reducing the dependence on desalination or freshwater resources. Novel materials can be synthesized from natural resources that can inhibit corrosion and result in considerable savings to the country's economy. Key research will cover the synthesis of nanomaterial's, inhibitors, Advanced treatment technologies, electrolysis.
People	 **Lead: Dr Geetha Devi** College of Engineering	**Team:** Dr Saravanan A M Dr. Anna Jesil Dr. Shah Jahan Dr. Lakkim Setty Rao Dr Santosh Madhav Walke Dr. Syed Murtuza Ali Dr. Priy Bart Dwivedi Mr. Shabib Sulaiman Ali Al Rashdi Mr. Ganesh Nagraj Patil Ms.Amira Sulaiman Rashid Khamis Al Gharibi ***Other departments :*** Dr Okedu Kenneth Eloghene Dr Aravind N Dr Sathyanarayan Rao C

	Email: geethadevi@nu.edu.om Mobile: 97649843 Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf	Dr Karthikeyan K.R. Ibrahim Issa Mohammed Al Balushi ***Staff from the College of Pharmacy*** Dr Alka Ahuja
Projects & achievement	Nano technology research at NU is featured by success with many funded research projects from TRC, industries, and NU • Characterization and Treatment of Textile Industry Effluents using Nanotechnology (IIC Project) • Application of Solar Nano-Photo Catalysis in Reverse Osmosis Pre-treatment Process (TRC ORG Project) • Synthesis, Characterization and Application of Magnetic Nanoparticles in the Removal of Copper from Aqueous Solution (2017-18) • Preparation and Characterization of Polyelectrolyte Nanoparticles. • Extraction and Analysis of D-limonene from waste Orange Peels, Internal Funding, 2015-2016. • A Study on the Encapsulation and Controlled Release of Ciprofloxacin Hydrochloride from Natural Degradable Capsules. (2019-20) – (TRC) • Project Title: A Study on the Preparation and Characterization of Gold Nanoparticles for Biomedical Applications (2019-20) – National University • Treatment and Reuse of Domestic greywater using Adsorption method, 2014-2015, (Furap, TRC) • Synthesis and Characterization of Unsaturated Polyester based composites using Algae, 2016-2017, (Furap, TRC) • Development of anti-corrosive polyurethane coatings from date seed oil, 2017-2018, (Furap, TRC) • Experimental Scrutinization on leachate Treatment of Engineered Landfill site for Safe Oman, 2019-2020 (URG, TRC) • Preparation and Characterization of Polyeletrolyte Nanoparticles (Internal Fund) • Kinetic Modeling Studies of Biodegradable Nano Capsules (Internal Fund) • A Study on the Preparation and Characterization of Gold Nanoparticles for Biomedical Applications (Internal Fund) • Extraction and Characterization of Bio polymer from Crab shell using Green and Sustainable Techniques (MOHERI-TRC/RG 2019) • A Study on the Encapsulation and Controlled Release of Ciprofloxacin Hydrochloride from Natural Degradable Nano Capsules (MOHERI-TRC/URG-2019) • Kinetic Modeling studies of Biodegradable Nano capsules containing Anti-tuberculosis drug – On going • Ultra-sonication Mediated Extraction of valuable Metals from Spent Catalyst (TRC

Recently featured publications

The Nanotechnology research team has trained a good number of PhD scholars, more than 30 Masters's dissertations, and over 40 publications in international peer-reviewed journals over the last 6 years in the area of nanotechnology.

1. **PhD Thesis completed** : Preparation and Characterization of Natural Degradable Nano and Micro Capsules using Layer-by-Layer Technique.
2. **Ongoing PhD in the area of Nanotechnology**
3. : "Preparation, Characterization and Applications of TiO2 , ZnO nanoparticles in waste water treatment" Student Name: Ms. B.M. Sangeetha
4. : "Synthesis, Characterization and Applications of Nanoparticles using Marine Algae" Student Name: Ms. Anjali K P
5. : Experimental Studies on Treatment of Industrial Waste water using Marine Algae. Student Name: Ms. Nabila Nasser Said Al-Rashdi
6. Development of Novel Nanomaterials for Sustainable and Affordable Clean water
   i. Student Name: Noura Ali Moosa Al-Bulushi

The recently featured publications include:

7. K.P. Anjali, B.M. Sangeetha, M. Geetha Devi, R. Raghunathan, Susmita Dutta, Seaweed Mediated Fabrication of Zinc Oxide Nanoparticles and their Antibacterial, Antifungal and Anticancer Applications, Chemistry Select (2021), 6(4):647-656 (Wiley Publication, Impact Factor 1.8) DOI: 10.1002/slct.202003517
8. B.M. Sangeetha1, Noura Al Balushi2, K.P.Anjali1, M. Geetha Devi*2, Susmita Dutta1, Mohammad AL Abri3, Fabrication, Characterization and Application of Polymer based Nanomaterials in the Removal of Pollutants from Industrial Effluents, Environmental technology & Innovation, (2021) Elsevier Publication – Impact Factor 3.5 (Accepted for Publication) – SCOPUS
9. Khadija Salim Abdullah Al Balushi, Geetha Devi, Amira Sulaiman Rashid Khamis Al Gharibi, Alaa Saif Mohammed Al Hudaifi, Development of chitosan-TiO2 thin film and its application for methylene blue dye degradation, International Journal of Environmental Analytical Chemistry, (2021) Taylor & Francis Publication - Impact Factor 1.8 (Accepted for Publication) - SCOPUS
10. Moza Saif Alkalbani1, M. Geetha Devi2*, Anna Jesil, Joefel Jessica Casino Dumaran, Sonia Ibarra Buscano, Removal of organic pollutants from textile mill effluent using Azadirachta Indica powder, Walailak Journal of Science & Technology (2021) (Accepted for Publication).- SCOPUS
11. K.P. Anjali, B.M. Sangeetha, M. Geetha Devi, R. Raghunathan, Susmita Dutta, Bioprospecting of seaweeds (Ulvalactuca and Stoechospermummarginatum): The compound characterization and functional applications in the medicine-a comparative study, Journal of Photochemistry & Photobiology, B: Biology, (Elsevier Publication, Impact Factor = 4.1) (2019). 200, 111622. https://doi.org/10.1016/j.jphotobiol.2019.111622
12. 3. Mulook Thane Khamis Al Jabri, M. Geetha Devi* and Mohammed Al Abri. Synthesis, Characterization, and Application of Magnetic Nanoparticles in the Removal of Copper from Aqueous solution, Applied Water Science (2018) 8:223 (Springer Publication) https://doi.org/10.1007/s13201-018-0872-x
13. 4. Ibrahim Ismail, Sanjana Balachandran, M. Geetha Devi*. Synthesis, Characterization, and Application of Nanoparticles in Wastewater Treatment, Indian Chemical Engineer. (2018), 60(2), 77- 88 (Taylor & Francis Publication). https://doi.org/10.1080/00194506.2018.1469099
14. 5. Noura Ali Moosa Al Balushi, M. Geetha Devi*, Mohammed Al Abri. Preparation and Characterization of ZnO Nanoparticles, Journal of Nano Science and Technology (2016), 5(3), 14-19.
15. 6. M. Geetha Devi*, Sanjana Balachandran. A Review on Synthesis, Characterization and Applications of Silica Particles. International Journal of Advanced Engineering Research and Technology (2016), 4(7), 249-255.
16. 7. M. Geetha Devi*, Susmita Dutta, Ashraf Talib Al- Hinai and S. Feroz, Encapsulation and kinetic release studies of Rifampicin from Chitosan- Dextran Sulphate Capsules, Korean

Journal of Chemical engineering, (2015), 32:118-124. (Springer Publication- Impact Factor = 2.7). https://doi.org/10.1007/s11814-014-0161-9.

17. 8. Saravanan A M, Ahmed Soud Said, Anna Jesil, Adeeb Mohammed Salim, Experimental Studies on Treatment of Wastewater using Cladophora sp. and advanced Oxidation, World Review of Science, Technology and Sustainable development, Inderscience Publishers, SCOPUS, 2020 – Accepted for publication.
18. 9. A M Saravanan, Asma Said Al Kharusi, Anna Jesil and Shabib Rashdi, "Experimental scrutinization on the conversion of seawater intro drinking water using solar energy", Applied Solar Energy Journal (SPRINGER), Vol 53, No.3, 238-242, 2017.
19. 10. Sumaiya Al ghuzaili, Anna Jesil and Saravanan A M, Extraction of Calcium Phosphate from Animal Bones, International Journal of Engineering Research and Technology, vol 8, Issue 1, Jan 2019, pp.136-138.
20. 11. Adhari al Amri, Anna Jesil, Adeeb Salim and Saravanan A M, Extraction of Essential oil from Frankincense using steam distillation, International Journal of Trend in Research and Development, Vol 6, Issue 1, pp.87-89, 2019.
21. 12 Aljuboury, D. A. D. A.; Palaniandy, P.; Aziz, H. B. A.; Feroz, S. Treatment of Petroleum Wastewater Using Combination of Solar Photo-Two Catalyst TiO2 and Photo-Fenton Process. J. Environ. Chem. Eng., 2015, 3 (2), 1117–1124. https://doi.org/10.1016/j.jece.2015.04.012.
22. 13 Aljuboury, D. A. D. A.; Palaniandy, P.; Aziz, H. B. A.; Feroz, S.; Amr, S. S. A. Evaluating Photo-Degradation of COD and TOC in Petroleum Refinery Wastewater by Using TiO2/ZnO Photo-Catalyst. Water Sci. Technol., 2016, 74 (6), 1312–1325. https://doi.org/10.2166/wst.2016.293.

23. 14 Varghese Manappallil Joy; Shaik Feroz; Susmita Dutta. Solar Nanophotocatalytic Pretreatment of Seawater : Process Optimization and Performance Evaluation Using Response Surface Methodology and Genetic Algorithm. Appl. Water Sci., **2021**. https://doi.org/10.1007/s13201-020-01353-6.

Resources /lab facilities

The research work we undertake is mainly focused on nano-materials development and wastewater treatment. We are equipped with a variety of instruments including :

1. Total Organic Carbon Analyzer (TOC)
   This equipment which is from SCHIMADZU, JAPAN can analyze Total carbon (TC), Total Inorganic Carbon(IC) and Total Organic Carbon (TOC)

   Range: 4 µg/L to 30,000 mg/L(ppm)

2. Inductively Coupled Plasma Emission Spectroscopy (ICPE)
   This equipment from SCHIMADZU,JAPAN is used to analyze the elements and heavy metals present in water sample (parts per trillion-ppt accuracy)

	The following elements can be measured in a single run but more elements could be analysed depending on the standard stock used for calibration. Ag, Al ,B,Ba,Bi,Ca,Cd ,Co,Cr, Cu, Fe, Ga, In, K Li,Mg,Mn,Na,Ni,Pb,Sr,Ti ,Zn 3. FTIR  **Fourier transform Infrared Spectroscopy (FTIR)** 4. BOD Incubator…which is used to measure the Biological Oxygen Demand (BOD) of a given sample. 5. COD Digester/Photometer…….This equipment is used to test the Chemical Oxygen Demand (COD) of water sample 6. Water Analysis Kit …This is a kit with three probes using which we can measure PH, Dissolved Oxygen, Salinity, Conductivity etc of the water sample 7. Turbidity Meter:……..Range : 0.001 to 100 Nephelometric Turbidity Units (NTU) 8. Fluorimeter- Make : Jenway, Range : 190-650 nm (used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light) UV Radiometer Make: KIPP&ZONEN, Range: 280-400 nm(0-400 W/m2) (Used for the accurate measurement of solar ultraviolet radiation 10. Microscope: Specifications: 4x, 10x, 40xR, 100xR Oil Imm. Objectives,40x, 100, 400x, 1000x Magnification,30° Inclined Binocular Viewing Head, Widefield 10x Eyepieces 11. Sonicator : Capacity: 50 LITER, Cleaning Frequency: 33 KHz/ 25 KHz
News & events/training (if any)	The group engaged in many scholarly activities as given below : • Organized the National conference on Emerging Trends and Innovations in Chemical and Process Engineering. • Organized two days' workshop on Emerging techniques on wastewater treatment.

Core Research Area	6 Artificial Intelligence & Machine Learning (AIML)
About the Research	The AI research group is interested in a variety of algorithms that mimic aspects of human intelligence or other biological systems. This research group conduct applied research in Applications of AI and ML in Engineering which includes; automated planning, , robotics, data mining, image processing, healthcare and medical, vision learning, computational systems, manufacturing areas from the aspects of fault diagnosis, quality inspection, improving the safety of working places and other aspects as well. Research activities are based on four main conceptual axes and their main fields of application are: (1) deep learning, (2) pattern recognition, (3) adaptive and intelligent systems, and (4) optimization of complex systems. The techniques developed by this research group can be used to solve concrete and complex problems, for example, in the development of convolutional neural networks to detect tumors or the level of depression of a patient, and this in a context where must deal with a massive amount of data that typically has limited annotations. The fields of application which are the subject of our main research initiatives are: • Analysis of medical, satellite, aerial images, etc. • Biometrics: recognition of individuals from the signature, the face, the voice, etc. • Affective computing for health monitoring • Data mining and Robotics • Manufacturing inspection and machine fault diagnosis The aim of the proposed research is to develop the appropriate software solution in various field including Robotics, fault diagnosis of machines , automated inspection of process , biometrics, data mining and health sector for example to detect, various lung infections, including the COVID19, brain abnormality detection (Tumor and Stroke assessment), retinal diseases, skin infection, blood level infection using the histopathology assessment. Research in healthcare involves both discovery and invention. Recently, due to various reasons, the occurrence rates of chronic and infectious diseases in humans are gradually rising. The early detection of the disease systems is very essential to cure the patients using appropriate treatment facilities. Hence, it is necessary to develop an appropriate software tool to support the doctor during the image-assisted disease diagnosis.

Research Team members (COE, COMHS, Doctors from Hospital and external research member)	**Lead:** Dr K.Suresh Manic College of Engineering  **Email: sureshmanic@nu.edu.om** **Mobile : +96891990856** **Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf**	**Team:** **1.** Mr Ali Abdullah Hamed Al Mahruqi(HOD,ECE) **2.** Dr Feras Al Attar (Asst Prof, COE) **3.** Dr Moammer Al Tobi (Asst Prof CoE) **4.** Dr Vijayalakshmi (Asst Prof, COE) **5.** Dr Geetha Achuthan (Asst Prof, COE) **6.** Dr Mustafa Rashid AL Khaifi (HOD Radiology, Rustaq Hospital,Oman –Doctor, External Member) **7.** Dr. Nitin Vishwakarma (Asst prof, Anatomy, CoMHS) **8.** Dr V. Rajinikanth (Prof, SJEC, India-Researcher External Member) **9.** Mr Imad Saud Al Naimi (Senior Lect, COE) **10.** Mr Saleh Salim Khamis Al Araimi(Senior Lect, COE)
Projects & achievement	1. Optimal design of an automated intelligent framework for diagnosing and segmenting area of Atropy,(CCE-RG-project funding). 2. Development of Heuristic Algorithm based Tool to Extract and Evaluate Tumor Section from Brain MRI, (TRC- project funding). 3. An advanced mobile application powered with machine learning to provide improved 24/7 Healthcare Services (TRC- project funding). 4. Intelligent Educational System for Autistic children using Augmented Reality and machine learning (TRC- project funding). 5. Completed One PHD student on research title “Optimal Multi-level Image Thresholding using Levy Flight driven Algorithms”2020 6. Awarded Best Research Prize award for the project title “Development of image processing methodology to analyze cancer cell images”. 7. Awarded Best Research Prize award for Electrical & Electronics Engineering in the Engineering fair July 2014 for the project title “Design and Implementation of an EEG Sensor and EEG signal visualization”.	

Recently featured publications	1. Suresh Manic Kesavan, Aravind CV, Aminath Saadha, K. Pirapaharan, " Implementation of Real time brainwave visualization and characterization" – SOMChE in conjunction with RSCE, 2014 Special Issue in **Journal of Engineering Sciences and Technology**, Special issue 3, pp.no.50-59,Jan 2015**(SCOPUS cited).** 2. Suresh Manic Kesavan, Aminath Saadha, K. Pirapaharan, Aravind CV "Characterisation and separation of brainwave signals" **Journal of Engineering Science and Technology**, ISSN: 1823-4690, EURECA 2014 special issue, Jan 2015 pp 32-44 **(SCOPUS cited).** 3. Subadhra, S, Suresh Manic.K, Rajinikanth.V, Joyce Preethi.B "Optimal Multi-level Image Segmentation using Bounded Heuristic Search Technique" **Australian Journal of Basic and Applied Science**- AENSI Journals ISSN 1991-8178, 9(1) January 2015 pp 26-33. 4. Suresh Manic.K, Uma Suresh, Joyce Preethi.B and Leong Mun Loong "Multi-level Image Segmentation of RGB images using Otsu and Brownian Bat Algorithm" **Advances in Natural and Applied Science**- AENSI Journals ISSN 1995-0772, 9(5) May 2015 pp 74-81. 5. Suresh Manic.K, Krishna Priya Godwin, Rajinikanth.V " Image multithresholding based on Kapur and Tsallis Entropy and Firefly algorithm" **Indian Journal of Science and Technology**, ISSN 0974-6846, Vol 9(12) March 2016**.(SCOPUS)** 6. K.Suresh Manic, Nawf Al Shibli and Rahma Al Sulaimi 'SGO and Tsallis Entropy assisted segmentation of abnormal regions from brain MRI, **Journal of Engineering Science and Technology**, Special issue 9, pp.no.52-62, Sep 2018 **(SCOPUS and WoS cited) .** 7. Manic Kesavan Suresh, Imad Saud Al Naimi, Feras N. Hasoon and V. Rajinikanth. "Jaya Algorithm-Assisted Evaluation of Tooth Elements Using Digital Bitewing Radiography Images." **Book chapter**-Computational Techniques for Dental Image Analysis. IGI Global, 2019. 107-128. Web. 10 Oct. 2018. 8. Suresh Manic K., Hasoon F.N., Shibli N.A., Satapathy S.C., Rajinikanth V. (Jan 1, 2019) An Approach to Examine Brain Tumor Based on Kapur's Entropy and Chan–Vese Algorithm. In: Yang XS., Sherratt S., Dey N., Joshi A. (eds) Third International Congress on Information and Communication Technology. **Advances in Intelligent Systems and Computing**, chapter no 81, vol 797. PP 901-909 Springer, Singapore **(WOS, SCOPUS).** 9. Rajinikanth V., Satapathy S.C., Dey N., Fernandes S.L., Manic K.S. (Jan 1,2019) Skin Melanoma Assessment Using Kapur's Entropy and Level Set—A Study with Bat Algorithm. In: Satapathy S., Bhateja V., Das S. (eds) Smart **Intelligent Computing and Applications. Smart Innovation, Systems and Technologies,** vol 104.pp 193-202 Springer, Singapore **(WOS, SCOPUS).** 10. Amna Liaqat, Muhammad Attique Khan, Muhammad Sharif, Mamta Mittal, Tanzila Saba, K Suresh Manic* and Feras Nadhim Hasoon Al Attar, "Gastric Tract Infections Detection and Classification from Wireless Capsule Endoscopy using Computer Vision Techniques: A Review", **Current Medical Imaging(2020)** 16: 1, Bentham Science Publisher, Print ISSN 1573-4056,Online ISSN 1875-6603., **SCOPUS, WOS-IF 0.647** 11. K.Suresh Manic, Satish Tanavade, Mohammed Al Balushi, Saleh Al Araimi and Ayman Al Khazraji, "Development of Heuristic Algorithm based tool to extract and evaluate tumor section from Brain MRI and CT image" The 3rd Smart Cities Symposium (SCS) and Hachathan, 21-23 September 2020, University of Bahrain, Bahrain.-**SCOPUS– Accepted** paper ID 481570621440 12. Abir Tawfeeq, Hanin Ali Saif Al Wahaibi, K.Vijayalakshmi, 2019, IoT based Aquaculture System with Cloud Analytics, International Journal of Applied Engineering Research, Volume 14, Number 22, pp. 4136-4142
News & events/training (if any)	Details of any workshop, training course, etc 1. Workshop on Deep Learning for Multi-type Medical Imaging" june 2020 2. FDP on Medical Signal and Image Analysis june 2020

	3. Core Point of Care Ultrasound (POCUS); Oman Medical Speciality Board, Oman; 29-30 March 2019 4. MRI/MDCT of the Abdomen Workshop, February 7 – 9/ 2015 Muscat, Oman. 5. CT colonography workshop , April 26-27, 2019, Prof Andrea Laghi
Expected outcomes	Development of the appropriate software solution to support the clinical level disease detection. Practical outcome: Software solution for the hospital needs. Academic level outcome: Research publications to demonstrate the research standards of National University. The research outcome includes the possible publications in; • Patents • Reputed conferences • Book chapters • Indexed journals • Authored/Edited books in reputed publishers, such as CRC Press, Springer, Elsevier, IOS Press, and Willey-IEEE.

Core Research Area	7 Water & Environmental Sustainability (WES)	
About the Research	This multidisciplinary group is dedicated to realizing sustainable development by efficient use of natural resources and transition towards the circular economy. This group conducts research and consultancy on a wide range of water resources, environmental and allied areas. It includes water resources, wastewater treatment technologies: like membrane technologies, water desalination, membrane bioreactors, microbial fuel cells, modeling studies for wastewater recycling. Waste to material and energy recovery technologies: like biogas production, algal biofuel, MFCs, activated carbon production from waste, recycling, and recovery of different waste materials, developing eco-friendly techniques and materials. Conducting studies on achieving SDGs, circular economy, resource recovery, EIA, air pollution, and climate change. Further, this group also takes up research in the area of sustainable development of water resources and management and has a strong research base in groundwater assessment, flood assessments, dam reservoir operation, dam reservoir water quality, water-energy-food nexus, stormwater collection systems, and water distribution networks	
People	**Leads:** **Dr. Akbar Karimi (Water resources)**  akbarkarimi@nu.edu.om Ext 565 +968 91175743	**Team:** Dr. S.V. Satyanarayana Dr Saravanan Dr Geetha Devi Mr. Mohd. Abdul Nasir Ms. Qudsia Saba Ms. Eman Muhye Adeen Muhye Al Hatali Ms. Maryam Ali Suliman Al Subhi

Projects & achievement	1. Research Grand (Call-2020)- Development of Noble Membrane Biofilm Fuel Cell (MBfFC) for Simultaneous Oilfield Water Treatment and Electricity Generation – Principal Investigator: Dr. Sudheer Kumar Shukla 2. URG (Call-2020) - Development of noble fouling resistant membrane for wastewater treatment -Mentor: Dr. Sudheer Kumar Shukla 3. URG (Call-2019) - Simultaneous wastewater treatment and electricity generation Using microbial fuel cell- Mentor: Dr. Sudheer Kumar Shukla. 4. Environmental Impact Assessment Report Update for Al Duqm Integrated Waste Management Facility for Be'ah with Yahya Engineering- Consultant: Dr. Sudheer Kumar Shukla, (2019). 5. URG (Call-2018) Comparative study of Carbon-dioxide absorption between Polyethyleneimine (PEI) mixed with paint and raw polyethyleneimine- - Mentor: Ms. Qudsia Saba 6. URG (Call-2017) A cost-effective technology to produce potable water using solar energy-based electrolytic cell Mentor: Dr Sathyanarayana 7. URG (Call-2016) Membrane Bioreactor Reject Water Pre-Treatment to Increase Membrane Life and to Decrease Fouling- Dr Sathyanarayana 8. URG (Call-2017) A cost-effective technology to produce potable water using solar energy based electrolytical cell . Dr Sathyanarayana
Recently featured publications	1. Hajar Al Subhi, Mohammed Salim Adeeb, Mukesh Pandey, Hafez Al Sadeq, Deepak Kumar, Sudheer Kumar Shukla, Effect of different activation agents on the pollution removal efficiency of date seed activated carbon: process optimization using response surface methodology, Applied Water Science 10:166, (2020) 1-9. 2. Sudheer Kumar Shukla, Noof Rashid Al Mushaiqri, Hajar Mohammad Al Subhi, Keunje Yoo, Hafez Al Sadeq Low-cost activated carbon production from organic waste and its utilization for wastewater treatment. Applied Water Science, 10, 62 (2020), 1-9. 3. Sudheer Kumar Shukla, Prerana Pandey, Keunje Yoo (2019) Commercial Potential of Phycoremediation of Wastewater: A Way Forward. In: Gupta S., Bux F. (eds) Application of Microalgae in Wastewater Treatment. Springer, Cham 4. Keunje Yoo, Hyunji Yoo, Jae Min Lee, Sudheer Kumar Shukla, Joonhong Park, Classification and Regression Tree Approach for Prediction of Potential Hazards of Urban Airborne Bacteria during Asian Dust Events, Nature Scientific Reports, volume 8, 11823, (2018) 1-11. 5. Vivek Kumar, Madan Sonkar, Pooja, Sudheer Kumar Shukla (2018). Recent Advancement on Bioaugmentation Strategies for Process Industry Wastewater (PIWW) Treatment. In: Bhattacharya S., Gupta A., Gupta A., Pandey A. (eds) Water Remediation. Energy, Environment, and Sustainability. Springer, Singapore. 6. Sudheer Kumar Shukla, Joseph V. Thanikal, Latifa Haouech, Sanjay Govind Patil, Vivek Kumar (2017). Critical Evaluation of Algal Biofuel Production Processes Using Wastewater. In: Gupta S. K., Dr. Malik A., Bux F. (eds) Algal Biofuels: Recent Advances and Future Prospects. Springer International Publishing AG. 7. Ali Torabi Haghighi, Mojtaba Sadegh, Siavash Behrooz-Koohenjani, Ali Akbar Hekmatzadeh, **Akbar Karimi** & Bjørn Kløve (2019) The mirage water concept and an index-based approach to quantify causes of hydrological changes in semi-arid regions, Hydrological Sciences Journal, DOI: 10.1080/02626667.2019.1691728 8. Mohammad Reza Nikoo , **Akbar Karimi**, Reza Kerachian, Keyhan Govahi, (2019): Optimum Operation of Reservoirs in the Karkheh Basin in Iran Considering Impacts of Non-integrated Development and Climate Change, Iranian Journal of Science and Technology, Transactions of Civil Engineering, 43, pp. 37-47. 9. Azizallah Izady, Osman A.E. Abdalla, Ata Joodavi, **Akbar Karimi**, Mingjie Chen and Andrew Tompson, (2017): Groundwater recharge estimation in arid hardrock-alluvium aquifers using

combined water table fluctuation and groundwater balance approaches, Hydrological Processes (31).

10. Izady A., Abdalla O., Sadeghi M., Majidi M., **Karimi A.** and Chen M., (2016): A Novel Approach to Modeling Wastewater Evaporation Based on Dimensional Analysis, Journal of Water Resources Management (30, 8).

11. S.V. Satyanarayana, Assessment of Industrial Wastewater Treatment Efficiency with Eco-friendly Coagulants. -A Case Study. International Journal of Innovations in Engineering and Technology. Dec 2019. 15(1), pp.49-57.
12. S.V. Satyanarayana, Prediction of California Bearing Ratio through Empirical Correlations of Index Properties for Tropical Indian Soils. International Journal of Innovations in Engineering and Technology, Dec 2019. 15(1), pp.67-77.
13. Satyanarayana. S.V, Ahmed.H. Al-Balushi A Feasibility Study to Convert Steel Industry Solid Waste into a Red Oxide Primer, International Journal of Waste Resources, Feb 2020. 10(1), pp.1-5
14. SV. Satyanarayana, The Fouling on MBR Membranes, Prevention and Control-A Case Study, International Journal of Innovations in Engineering and Technology, July 2020 Vol. 16 (4), pp.44-52

Resources /lab facilities

The research work mainly carryout by the group is Wastewater treatment, bioenergy production, biogas, algal biofuel, activated carbon production from waste, recycling, and recovery of different materials, SDGs, circular economy, and resource recovery.

We have variety of equipment including

- AAS
- ICP
- GC
- Anaerobic Digesters
- MFC
- COD meter
- TOC
- Hach Mutlimeter
- Centrifuge
- Spectrophotometer
- Flame photometer
- pH, Conductivity meter
- BOD incubator

Lab scale anaerobic Digester

Pilot scale anaerobic Digester

	• Oven • Furnace • Deep freezer etc.	 ICP
News & events/training (if any)	The group is engaged in many scholarly activities and getting published in media 1. "Scientist of the Year" Award from the GISR Foundation and The American College of Dubai, Oct., 2019. 2. "Certificate of Merit" for supervising award-winning project from Middle East Desalination Research Center (MEDRC), Oman, Sept.2019. 3. Interview on 'COVID-19: the lessons we can learn on World Environment Day', with Times of Oman tv on 4th June, 2020. https://www.youtube.com/watch?v=Il9OXaMbVrs&feature=youtu.be&fbclid=IwAR1p5bxBxm4WGNUgds_1x9zIOpLoAMVLJsFnzEX6-cA-vnhx2OnpVzdEVsg 4. Featured story on "Learn, Introspect and Correct" Published in T-Magazine Published by Times of Oman on 4th June, 2020. https://t.timesofoman.com/2020/06/03/the-lessons-we-can-learn-from-covid-19/ 5. Article "Coronavirus nature's warning" Oman observer, 5th June, 2020, https://www.omanobserver.om/wp-content/uploads/2020/06/OmanObserver_5-6-2020.pdf 6. Article on "Bleaching powder bad for health" 25th May, 2020. https://www.omanobserver.om/bleach-bad-for-health/ 7. Did "Beat Plastic Campaign" to make aware public about harmful effects of using plastic.	

Core Research Area	8 Innovative Sustainable Materials and Structures (ISMS)
About the Research	The cost of civil infrastructure constitutes a major portion of the national wealth. Its rapid deterioration has thus created an urgent need for the development of novel, long-lasting and cost-effective methods for repair, retrofit, and new construction. In the present days' life extension of structures through strengthening is becoming an essential activity. A host of strengthening systems has to be devised and adopted over the years. The choice of the strengthening system depends on the specific performance requirements. As the number of civil infrastructure systems increases worldwide, the number of deteriorated buildings and structures also increases. Complete replacement is likely to be an increasing financial burden and might certainly be a waste of natural resources if upgrading or strengthening is a viable alternative. Few attempts have been done for flexural strengthening and shear strengthening of RC beams and short and long column retrofitting using ferrocement, SIFCON, and FRP. Appreciable results were found. Further study is in progress in this area. An attempt is made to develop the eco-friendly (geopolymer) concrete using low calcium fly ash and locally available material spent catalyst with 100% replacement of cement. This investigation consists of three studies. In the first study, the development of mix proportions of various grades of geopolymer concrete such as C25, C30 and C40. The results obtained are encouraging and similar to the corresponding strength of cement concrete. In the second study, the developed geopolymer concrete of C25 grade is used to cast the solid block of size 200×200×400mm. In the third study, a beam i.e. prism of size 100x100x500mm with two-point loading was done. Eco-friendly concrete with 100 percent replacement of cement undertakes three social responsibilities, viz. a practical solution to the global problem of solid waste management, controlling CO_2 emission and sustainable less cost construction material. The present study focusing on locally available material, say spent catalyst.

People	**Lead:** Dr. R. Balamuralikrishnan  Email: balamuralikrishnan@nu.edu.om Mobile: +968-91183580 Link: https://www.nu.edu.om/research/docs/ResearchFacultyProfile-CoE.pdf	**Team:** (i) Dr. Hafez Al Sadeq (ii) Dr.N. Aravind (iii) Dr. S. Rajesh Kumar (iv) Dr. Ajayakumar (v) Ms. Asima Kaleem (vi) Ms. Soleen (vii) Mr. Arifuzzaman (viii) Ms. Amani Salim Matar Al Badi

Projects & achievement	(a) Undergraduate Research Grant (URG) "Experimental Study on Shear Strengthening of Reinforced Concrete (RC) Beam Using GFRP (Glass Fibre Reinforced Polymer) Chopped Strand Mat (CSM) Composites" -Total amount OMR1500 by TRC, Sultanate of Oman, completed in the year 2019-20. (b) Faculty Mentored Undergraduate Research Award Program (FURAP) "Study on Eco-Friendly Concrete Block without Cement and Curing" -Total amount OMR 2400 by TRC, Sultanate of Oman, completed in the year 2015-16.	
Recently featured publications	(I) Aravind N., Amiya K. Samanta, Joseph V. Thanikal and D. K. Singha Roy., (2019), "Comparative study on the performance of corrugated GFRP laminates on normal and pre-cracked flexural concrete members", Asian Journal of Civil Engineering, Vol. 20, pp.799-806. doi.org/10.1007/s42107-019-00145-x. (II) Balamuralikrishnan, R., Al Madhani M., Al Madhani R. (2019), Study on Retrofitting of RC Column Using Ferrocement Full and Strip Wrapping, Civil Engineering Journal, Vol. 5(11), pp.2472-2485. (ISSN No.2476-3055). (III) Balamuralikrishnan, R., Saravanan, J. (2019), Effect of Alccofine and GGBS Addition on the Durability of Concrete, Civil Engineering Journal, Vol. 5(6), pp.1273-1286. (ISSN No.2476-3055). (IV) Balamuralikrishnan, R., Saravanan, J. (2019), Study on Bond Strength of Alccofine Based Normal and High Strength Concrete, Civil Engineering Journal, Iran, Vol. 5(3), pp.679-689. (ISSN No.2476-3055). (V) Aravind N., Amiya K. Samanta, Joseph V. Thanikal and Singha Roy D. K., (2017), "An experimental study on the effectiveness of externally bonded corrugated GFRP laminates for flexural cracks of RC beams", Construction and Building Materials, Vol. 136, pp.348-360. DOI: .org/10.1016/j.conbuildmat.2017.01.047. (VI) Hamza Salim Mohammed Al Saad., Hoby P. Mohandas and Aravind N., (2017), "An Experimental Study on Strengthening of Reinforced Concrete Flexural Members using Steel Wire Mesh", Curved and Layered Structures, Vol. 4, pp.31-37. DOI: 10.1515/cls-2017-0004. (VII) S. Rajesh Kumar, Amiya K. Samanta, D. K. Singha Roy, (2016), Characterization and development of Eco-friendly concrete using Ground Granulated Blast Furnace Slag and Alccofine, Research Journal of Applied Sciences, Year: 2016 | Volume:11, Issue:5, Page No.:183-187, DOI: 10.3923/rjasci.2016.183. (VIII) S. Rajesh Kumar, Amiya K. Samanta, D. K. Singha Roy, (2016), An experimental study on the compressive strength of alccofine with silica fume based concrete, Applied Mechanics and Materials, Vol. 857 pp.36-40.	
Resources /lab facilities	The research work mainly focuses on strengthening / retrofitting of structural elements like beam, column and slab. Experimental investigation on beam strengthening for measuring Load - deflection behaviour using load cell and LVDTs. Developing cement less concrete for	

homogeneous mix and early polymerization process widely using pan mixer and heat chamber.

Our department established a non-destructive testing (NDT) and destructive testing (DT) lab facilities for assessing condition monitoring and repair and rehabilitation of structures.

Load Cell
1000 kN Capacity

Active Area of Research:

- Development of cement less concrete using different source materials.
- Partial replacement in concrete ingredients.
- Investigation of RC beam using externally bonded CFRP, GFRP, Ferrocement, SIFCON and SIMCON.
- Condition assessment of deteriorated reinforced concrete structures and steel structures.
- Assessment of seismic zone upgradation for RC and Steel structures.
- Retrofitting of RC beams and columns.

Concrete Permeability Tester

Heat curing Chamber for concrete polymerization

		 Rebar Corrosion Analyzer in Existing Structures (NDT)
News & events/training (if any)	**i)** One-week short-term courses on Structural Analysis, Design and Detailing of RC Buildings – Petrochemical Industries for PDO, Sultanate of Oman from 9th June 2019 to 13th June 2019. (Total 13 nos. manager level staff participated). **ii)** One-week short term courses on STAAD Pro for BNE Department, L3 and L4 students, CCE, Sultanate of Oman from 28th January 2018 to 1st Feb 2018. (Total 22 students participated). **iii)** One-week Bridge course on Strength of Materials for BNE Department, L2 and L4 students, CCE, Sultanate of Oman from 26th June 2018 to 3rd July 2018. (Total 93 students participated). **iv)** Two Weeks short-term training program on Building Maintenance for Ministry of Justice, Sultanate of Oman from 16th April to 27th April, 2017.	