

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE

Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506015, TELANGANA, INDIA

काकतीय प्रौद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६०१५, तेलंगाना, भारत

కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము

(An Autonomous Institute under Kakatiya University, Warangal)

(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)

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IAAHP - CENTRE OF EXCELLENCE



Prof. K. Eswaraiah
Dept. of ME



Prof. K. Venu Madhav
Dept. of EIE



Dr. G. Ganesh Kumar
Dept. of ME



Dr. G. Saikumar
Dept. of ME

Vision: To Design, Develop and Manufacture a low cost Artificial Heart Pump with Magnetic Levitation into Indian Market.

Mission: Prepare a protocol for the design and test an artificial heart pump.

Objectives / Functions:

1. To generate the simulation model of an artificial heart pump using ANSYS 19.2 Work Bench, Fluent module.
2. To install mock up loop test setup used for performing hydrodynamic and hemolysis test.
3. To study the characteristics of blood in an artificial pump using mockup loop test rig.
4. To study the properties of a Ring Magnet used for levitation in artificial heart pump.
5. To study the characteristics of Brushless Direct Current (BLDC) motor control system used in Total Artificial heart.
6. To support and perform an animal testing using the pump developed by the team.
7. To release the product in to Indian market with low cost.

No. of activities conducted:

2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
08	09	0	07	08	05

Highlights of Major Activities:

First visit of Prof. Pesaru Sudhakar Reddy to KITSW to inaugurate IAAHP at KITSW on 12.02.2018



Meeting at KITS, Warangal Campus to discuss the activities to be performed

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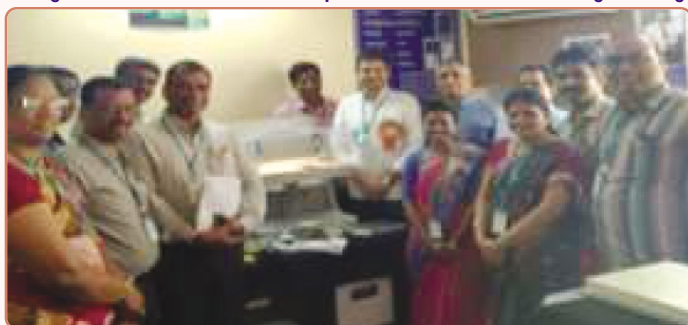


R-L: Row-1: Dr. K. Eswaraiah, Prof. and Head, MED, Sri Narayana Reddy, Treasurer, Capt. Laxmikantha Rao, Secretary & Correspondent, Dr. P.S. Reddy, Professor of Medicine, University of Pittsburgh, USA Dr. K. Ashoka Reddy, Principal, Sri. Rugveda Sunny, Research Associate, CBIT.
Row-2: Dr. G. Ganesh Kumar Assoc. Prof., of ME, Dr. A. Subhananda Rao, Project manager, SNIST, Dr. P. Ravinder Reddy, Principal, CBIT, Dr. A. Purushotham, Head of ME, SNIST.
Row-3: Dr. K. Venu Madhav, Associate Prof., of EIE, Dr. A. Madhukar Rao, Asst. Prof., of EEE, Sri. Avez Shariq, Asst. Prof., of ME.



R-L Row-1: Prof. K. Ashoka Reddy, Principal, Capt. Laxmikantha Rao, Secretary & Correspondent, Dr. P.S. Reddy, Professor of Medicine, University of Pittsburgh, USA, Dr. Naveen Chander Reddy, MD, AIG Hospitals, Sri. Rugveda Sunny, Research Associate CBIT, Dr. K. Eswaraiah, Prof. & Head of ME

Inauguration of IAAHP Lab in Department of Mechanical Engineering



L-R: Dr. P. Kamashki, Prof. & Head of IT, Dr. P. Srikanth, Prof. of ME, Dr. K. Raja Narendar Reddy, Prof. of ME, Dr. C. Venkatesh, Prof. of EEE, Dr. G. Ganesh Kumar Assoc. Prof., ME, Prof. K. Ashoka Reddy, Principal, Dr. M. Veera Reddy, Prof. of CE, Dr. V. Shankar, Prof. of CSE, Dr. M. N. Rao, Assoc. Prof. of EEE, Dr. K. Sridhar, Prof. of ME, Dr. B. Rama Devi, Prof. of ECE, Ms. Sumithra, Assistant Prof. of ME

12-Nov-2018: Inauguration of a one week Short Term Training Program (STTP) on Hands on Program on ANSYS software conducted as part of IAAHP



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Hydrodynamic Test by KITSW team at BITS Pilani, Hyderabad, Campus



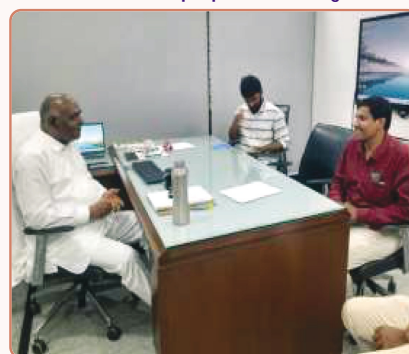
L-R: Dr. A. Madhukar Rao, Asst. Prof. of EEE, Dr. G. Ganesh Kumar Assoc. Prof., ME, Dr. K. Venu Madhav, Associate Prof., EIED

Inspection of the heart pump by Delegates from USA



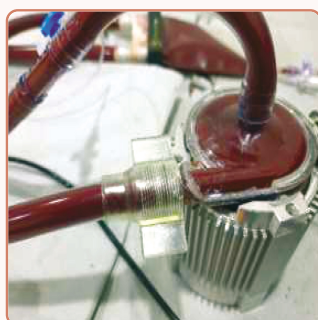
James Long, MD - Integris, OK, Medical Director for the Institution: Nazih Zuhdi, Transplant Institute- INTEGRIS Baptist Medical Center in Oklahoma City
Dr. Harvey Borovetz, Professor of Medicine, University of Pittsburgh Medical Center, Dr. P. Naveen Chander Reddy, MD, AIG, Hospitals, Hyderabad

Meeting at Laxven Systems, Hyderabad to discuss about properties of Magnet



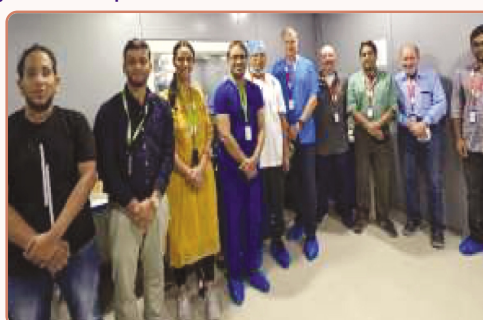
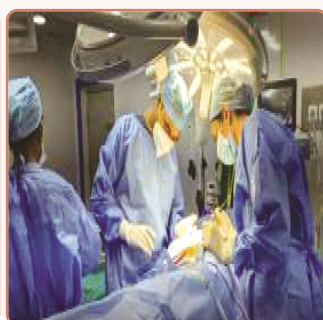
Sri. Chada Ramesh Reddy, MD, Laxven Systems, Me. Rahul, Student, Dr. G. Ganesh Kumar, Assoc. Prof. of ME

Ring thrombosis test on Centrimag and Injection moulded pump



Thrombosis Test at AIG by IAAHP Team to find the quality of Blood

5 days animal experiment conducted during 7-14 March 2023. USA team visited and guided the experiment



Collaboration with BITS Hyderabad for Von Willebrand Factor testing



L-R: Dr. K. Eswaraiiah, Prof. of ME, Dr. K. Venu Madhav Prof. of EIE, Dr. K. Ashoka Reddy, Principal, Sri. Chada Ramesh Reddy, MD, Laxven Systems, Dr. Srinivas, Sri. P. Narayana Reddy, Treasurer, KITSW, Capt. Laxmikantha Rao, Chairman, KITSW, Dr. P. S. Reddy, Prof. of Medicine, UPMC, USA, Sri. Sursh Kumar, DGM, Design, Vasantha Tools, Hyderabad, Dr. K. Raja Narendar Reddy, Professor & Head of ME, Dr. G. Ganesh Kumar, Assoc. Prof. of ME, Dr. G. Sai Kumar, Asst.Prof. of ME, Mr. Rahul, Student of KITSW



Visit of Sri KTR, Minister of IT, Telangana to the IAAHP lab on 05/05/2023



One Week Short Term Training Programme on Hands on Programme on Additive Manufacturing (HPAM) from 11-16 March , 2023", at KITSW

Activities performed by IAAHP Team:

1. A 3 D Centrifugal pump was designed in CATIA used in Total Artificial Heart (TAH)
2. Performed a vast Literature Survey on Patents and publications pertaining to development of Centrimag pump.
3. Performed Computational Fluid Dynamics (CFD) Analysis in ANSYS 19.2, Fluent module of a pump designed in CATIA for generation of H-Q Curves.
4. Generated Simulation results of fluid flow through Centrimag Pump used in Total Artificial Heart (TAH) (H-Q Curves).
5. Fabricated a 3D printing Model of ex-corporal pump using Mark Two 3D Printing Machine
6. Installed a Mock Loop Test rig at KITSW for performing Hydrodynamic testing of a ex-corporal centrifugal pump.
7. Performed hydrodynamic test (trial runs) on fabricated pump on Mark Two 3D Printing Machine.
8. Developed protocol for Hemolysis test on Mock up loop test rig.
9. Performed Hemolysis Test at AIG Hospitals under the supervision of Dr. P. Naveen Chander Reddy, MD, AIG Hospitals successfully.
10. Developed a 3D printing Model of an ex-corporal Centrimag pump using Form Labs SLA (Stereo Lithography) 3 D printing Machine
11. Performed number of hydrodynamic tests to generate H-Q curves.
12. Performed number Haemolysis tests to generate the NIH (Normal Index for Haemolysis) of 0.0001(A primary requirement of the pump)
13. Performed an Animal Testing at Palamuru Bio Sciences (PBS) for number of times with the help of IAAHP Team.
14. Installed a test rig to study the properties of a Ring Magnet used in Left Ventricular Assisted Device (Centrimag Motor).
15. Developing a Von Willebrand Factor (vWF) test rig for evaluation of vWF with the collaboration of Dr. Suman Kapoor, BITS, Hyderabad
16. Developed a CAD Program to assemble the designed pump model using glue and further automated the gluing process using Hyrel 3 D printing Machine.
17. A student Mr. Rahul Vennam (B19ME127) was sponsored to perform his B. Tech Project at Laxven Systems, Cherlapally, Hyderabad to study the properties of a Ring Magnet.
18. Performed Hemolysis test on Centrifugal pump made of Poly Carbonate which is developed by Karthik Moulds using Poly Carbonate
19. Automated a Gluing Process on a 3D printing Model of a Centrifugal pump using Poly Carbonate
20. A 24-hour Animal study was performed at Palamuru Biosciences, Mahabubnagar during 08-09, September 2022. It was successfully conducted for 24 hrs. The animal was able to recover, eat grass, and drink water during the study.
21. Mickey Mouse connector for the loop in order to avoid ring thrombosis was designed. Three versions of the samples were designed.
22. 24 Hour ring thrombosis tests were conducted with and without Mickey mouse connector during 23-26, September 2022.
23. Hydrodynamic tests were conducted on the injection moulded samples at 500 mm of Hg pressure and 4 LPM flow rate.
24. Vasantha tool crafts is being included and a Die is being produced by them. Discussions happened regarding the die design.
25. Karthik Moulds and Dies has produced injection moulded components with tongue and groove design. It was observed that there are a few errors which are needs to be rectified and the same is communicated to them.
26. Dr. James long has visited IAHP lab at AIG hospitals, Gachibouli on 10.01.2023 to discuss about the progress.
27. IAAHP meeting was conducted at Laxven Systems on 11.01.2023.
28. Injection moulded components are made by Vasantha Tools for modified Pump model and they are tested for H-Q data, Hydrodynamics and Hemolysis tests successfully.

29. IAAHP team along with USA team has performed five days animal experiment during 7-14 March 2023. USA team visited and supervised the team for conducting the experiment successfully.
30. A total of Nine Animal tests were performed. The maximum survival obtained is 5 days. The centrimag pump was used in all the studies.
31. Dr. PS Reddy has visited KITS Warangal on 20.04.2023 and had a meeting with the faculty. Dr. G. Ganesh Kumar and Dr. G. Sai Kumar has presented the progress of IAAHP and further Prof. PS Reddy has discussed the major events in the project.
32. Sri KT Ramarao, Hon'ble IT Minister along with Capt. Laxmikantha Rao has visited IAAHP lab, KITSW on 05.05.2023 appreciated the team for the progress.
33. Dr. G. Saikumar has visited ASAIO 2023 conference held at San Francisco during 14-17 June 2023.
34. Dr. G. Ganesh Kumar and Dr. G Saikumar have visited AMTZ Vizag for ICEHTMC conference and World Health Innovation Forum during 10.11.2023 to 16.11.2023 at AMTZ, Vizag.
35. Glue dispensing robotic arm and UV curing equipment were procured by IAAHP lab KITSW to conduct gluing and UV curing operation for centrifugal pump parts.
36. Modified Pump Model in collaboration with Vasantha Tool Crafts Pvt. Ltd. For injection moulding to avoid wobbling.
37. Interacted with Andhra Pradesh Med Tech Zone (AMTZ) to perform Animal Studies. Further assisted them to set up Animal Testing lab.

Facilities Available in IAAHP Lab

S. No	Name of the Equipment/ Software	Cost of the equipment/ Software in ₹	Purpose of the equipment
3D Printer			
1	SLA Form 3B + <i>Sponsored by Alumni -Class of 1996 Exit Batch</i>	6, 77, 000-00	To generate the working model of the pump with surface finish of less than 0.2 µm
2	Mark Forge Mark Two 3D printing machine	16, 22, 500-00	To generate the working model of the pump using Onyx Material
3	Flash forge Dreamer Dual Extruder -Think 3D	85,000-00	To generate the experimental models of an artificial heart pump
4	ANSYS 19.2	5, 01, 500-00	To Simulate the fluid flow through pump
5	WORKSTATION-HP Z8 Work Station	10,68,000-00	To Generate H-Q Curves of an Artificial Heart Pump
6	Robot-Glue Dispensing System	6,96,200-00	For Joining Impeller Cover with impeller and also top casing and bottom casing of Heart pump
7	5000-EC with Light Shield & Manual Shutter: PN 39823	7,84,110-00	For curing the glue used to join Impeller Cover with impeller and also top casing and bottom casing of Heart pump
Total Cost Spent Till Now is about One Crore Twenty Lakhs Rupees Only			₹ 1, 20, 00, 000-00

Outcomes: Published One Patent on the Name of Principal, KITSW

S. No	Title of the invention	Date of Filing	Date of Publication with Application No.	Name of Inventor(s)	Grant No. with Date of Grant received
1	Left Ventricular Assisted Device with magnetic levitation	25/09/2020	09/10/2020 Application No. 202041041609 A	1. Dr. K. Eswaraiah 2. Dr. K. Sridhar 3. Dr. G. Ganesh Kumar 4. Dr. K. Venu Madhav 5. Dr. K. Ashoka Reddy	Awaiting for Grant

Published Six Conference Papers by faculty in American Society of Artificial Internal Organs (ASAIO) Journal, USA and Four Conference papers by Students

1. Rugveda Thanneeru, Sadia Alvi, Sai K. Gadakary, Ganesh K. Gampa, James Antaki, Harvey S. Borovetz, Naveen Chander Reddy, P. S. Reddy (2024), "In-Vitro Evaluation of India-US (INDUS) Magnetically Levitated Blood Pump", ASAIO Journal June 24, Volume 70, ISSN 1058-2916, Wolters Kluwer Publishers (Accepted On line)
 2. Rugveda Thanneeru, Sadia Alvi, Sai K. Gadakary, Ganesh K. Gampa, James Antaki, Harvey S. Borovetz, Naveen Chander Reddy, P. S. Reddy (2023), "INDUS: Economical Maglev Centrifugal Blood Pump for Developing Countries- Preliminary In-Vitro Hemolysis Testing", ASAIO Journal June 23, Volume 68 (2), ISSN 1058-2916, pp 63, Wolters Kluwer Publishers (SCI Journal).
 3. Ganesh Kumar, G., Sridhar, K., Ashoka Reddy, K., Venu Madhav K., Eswaraiah. K., (2021), "Experimental and Numerical Studies of a Centrifugal Heart Pump Used for Total Artificial Heart (TAH)", ASAIO Journal June 21, Volume 67 (2), ISSN 1058-2916, pp 88, Wolters Kluwer Publishers (Published abstract in ASAIO SCI Journal)
 4. Ganesh Kumar, Sridhar, K., G., Ashoka Reddy, K., Venu Madhav K., Eswaraiah. K., (2021), "Comparative Studies on six and four bladed Centrifugal Heart Pump Used for Left Ventricular Assisted Device (LVAD)", ASAIO Journal June 21, Volume 67(2), ISSN 1058-2916, pp 88, Wolters Kluwer Publishers (Published abstract in ASAIO SCI Journal)
 5. Ganesh Kumar, G., Ashoka Reddy, K., Venu Madhav K., Eswaraiah. K., (2020), "Mathematical and Experimental Studies On Effect of Number of Blades On Centrifugal Pump Used in Left Ventricular Assisted Device (LVAD)", ASAIO Journal June 20, Volume 66, ISSN 1058-2916, pp 83, Wolters Kluwer Publishers (Published abstract in ASAIO SCI Journal).
 6. Ganesh Kumar, G., Venu Madhav K., Eswaraiah. K., (2019), "Parametric Studies on Centrifugal Heart Pump for Total Artificial Heart (TAH) using Genetic Algorithms", ASAIO Journal, May-June 2019, Volume 65, ISBN 1058-2916, pp 143, Vol. 65, Supplement-1, ISSN: 1058-2916 Wolters Kluwer Publishers (Published abstract in ASAIO SCI Journal).
- Students published four Conference Papers in USA by utilizing the IAAHP Center of Excellence
6. Karthik Naganathan, Lavanith Togaru, "Design, Thermal and Computational Fluid Dynamic Analyses On Loop Heat Pipe Wick and Manufacturing with Selective Laser Melting", TFAWS 2019 - August 26-30, 2019.
 7. Karthik Naganathan, Lavanith Togaru, "Design and Optimization of Formula Car Suspension System", JETIR June 2019, Volume 6, Issue 6.
 8. Karthik Naganathan, Lavanith Togaru, "Design Of Exoskeleton For Musculoskeletal Support Of Human Body Under Low Gravity Conditions And Its Performance Evaluation By Fluid Dynamic Analysis", TFAWS 2020 - August 18-20, 2020.
 9. Karthik Naganathan, Lavanith Togaru, "Thrust Performance Evaluation of Chemical Rocket Engine by Thermal and Fluid Dynamic Analysis for Exhaust Gas Flow Subjected to Cooling", TFAWS 2020 - August 18-20, 2020.

Attended and presented Seminars in Symposia organized by IAAHP group in USA

1. G. Ganesh Kumar, K. Venu Madhav, (2019), Presented a Seminar on "Left Ventricular Assisted Device", 4th International Symposium on Indo-American Artificial Heart Project Symposium", held on 24.06.2019 at San Fran Cisco, USA
2. G. Ganesh Kumar, K. Venu Madhav, (2018), Presented a Seminar on Total Artificial Heart in IAAHP at KITSW", 3rd IAAHP Symposium, held on 16.06.2018 at Washington DC, USA.

Organized Four Faculty Development Programmes.

1. Organized "A One Week Faculty Development Programme on Disruptive "Disruptive Technologies in Digital Manufacturing (DTM-19)", from 25-29 November, 2019"
2. Organized "A One Week Faculty Development Programme on Research Methodology (RM-18) from 7-11 January, 2019" at Kakatiya Institute of Technology and Science, Warangal.
3. Organized "A One Week Short Term Training Programme on Hands on Programme on ANSYS Software (HPAS) from 12-16 November, 2018", Kakatiya Institute of Technology and Science, Warangal.
4. Organized "A One Week Short Term Training Programme on Hands on Programme on ADDITIVE MANUFACTURING - 2022 (HPAM-2022)", from 11-16, March 2023", Kakatiya Institute of Technology and Science, Warangal.