MECHATASTIC

VOL.3

MECHATRONICS CLUB

PRESENTS

MECHATRONICS CLUB

AUTOMATING THE STANDARDS!

3RD EDITION

A PUBLICATION OF THE DEPARTMENT OF MECHATRONICS AND CONTROL ENGINEERING

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Chairman Mechatronics Department

DR. ALI RAZA

In my message last year, I pointed towards solving current problems and creating innovative opportunities by merging different ideas together. It was also because the innate innovative spirit of mechatronics calls for it. In the current difficult situation our country is in, it is even more imperative that we create opportunities. Remember, an opportunity generally arises when it is desirable for humans, feasible from technical point of view and viable from business standpoint. But the bigger question is how to create such opportunities? There are different ways to answer this question but the one close to my heart is exploring current market needs that the existing solutions are unable to meet; and then developing those solutions. Probably, this quest can be started from exploring the imported items we Pakistanis are importing and try to work towards import substitution through indigenous development of those items. One can start from the data at Trademap.org. The faculty at Mechatronics is doing exactly that. We claim that the robots we have indigenously developed at our HCR Lab can substitute the costly imported robots at less than half the price, and then we can also provide after-sale service to the industry, locally. Such pursuits demand a bit of technical knowledge, some Entrepreneural mindset but a lot of persistence. I hope I am making sense. This magazine is showcasing some of our achievements in the last year, and I thank and congratulate all of you who are involved in these achievements.

President Mechatronics Club

ABDUL RAHMAN SAJID

In light of the scientific world marathon, the mechatronics club facilitates the narrative of development, technical growth, and problem-solving attitude adoption. We aim to generate engineering solution minds, endorsing the ideology of leadership and teamwork. “Together we can do so much” is the vision entitled to the club. As a club member, a student gets involved in managerial and technical roles. The most amazing part is when students of various ages, skill sets, and flexible viewpoints hustle together to achieve a common goal. I believe, the mechatronics club holds the vision of teamwork and the flame of engineering in its core values.

MEET THE TEAM

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Chief Editor Magazine

Faizan Tanveer
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Salman Farooq
Director Design

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Research & Documentation

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General Member
Research & Documentation

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Research & Documentation

Farzan Khan
General Member
Design

Muhammad Muiz
General Member
Design

Muhammad Rafay
General Member
Design

Muhammad Mohid
General Member
Design

ACKNOWLEDGEMENT

As we started using this magazine to showcase our work, the content has been revised considerably since last year. In this volume, students' counseling has significantly improved after we added diversity to the Alumni Success Stories and a section on Departmental achievements.

First, I would like to extend my regards to the Chairman of the Department of Mechatronics and Control Engineering, **Dr. Ali Raza**, for his guidance and knowledge that served as the foundation for drafting the table of content for the third volume of Mechatastic. Apart from this, I am grateful for the continuous supervision and suggestions of our chief editor **Dr. Ayisha Nayyar**, and the core body of Mechatronics Club, our respected President of Mechatronics Club, **Abdul Rehman Sajid**, and our media coordinator, **Areeba Azhar**, and PR secretary **Shaheer Ahmad Khan**. I want to acknowledge our faculty's and students' positive response in providing us with the relevant content for the magazine. Many instances in the magazine defined not only the actual value and potential of DMCE but also what the students of our department behold.

Under the relentless efforts and supervision of the Director of Research and Documentation, the following individuals imparted their valuable time and expertise for the research and documentation of the magazine's content followed by the Deputy Director of Research and Documentation, **Taha Qazi**, and the general members **M. Wasil Fayyaz**, **Ahmed Aslam** and **Talha Abid** from the Team Research and Documentation; Director of Team Technical, **Ali Sajid**; Deputy Director of Team Technical, **Fawaz Mehmood Mughal**; and the general members **Mughees Ahmad** and **Muhammad Anss** from the Technical Team; Former Director Sponsorship Team, **Noor Sultan** and the Director of Team Marketing, **Taha Khadim.**

I want to endorse the valuable contribution of the whole design team of the magazine, specifically, the design lead **Salman Farooq,** Director of Design; and the general members of the design team: **Ammar Rizwan, Muteeba Javaid, Muhammad Mohid Faisal, Muhammad Muizz, Farzan Khan, Muhammad Bin Abdullah, and Muhammad Rafay.**

I also want to express my admiration for the cinematography and logistics teams for their roles in the magazine work. All the teams remained committed throughout the process, and their contribution has been exemplary.

Faizan Tanveer

Director of Team Research and Documentation

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Mechatronics & Control Engineering

Mechatronics is a multidisciplinary field that refers to the skill sets needed in the contemporary, advanced automated manufacturing industry

Why Mechatronics?

By pursuing studies in mechatronics engineering, individuals can specialize in a specific area, such as robotics, machine learning, control systems, embedded systems, or automation, to contribute to the industrial and research sector. They can become educators, researchers, innovators, or entrepreneurs and leverage their expertise to advance the field and promote innovation in various industries, including manufacturing, aerospace, healthcare, and automotive. This contributes to the growing demand for mechatronics engineers today and in the near future.

Industry and Job Market

Mechatronics engineering is a highly competitive field and in demand among other multidisciplinary fields because of the increasing importance of automation and robotics in the industries, and to stand out in the job market, a mechatronics engineer needs to have a combination of technical skills such as proficiency in CAD/CAM software, control systems, programming languages, and electrical and mechanical systems design, along with the soft skills like communication, problem-solving, and teamwork. For example, Mechatronics systems are being used worldwide to design and operate industrial robots that perform welding, painting, and material handling in manufacturing plants and control the movement of cutting tools and workpieces in Computer Numerical Control (CNC) machines.

Mechatronics engineering is also used to design and implement hydraulic and pneumatic systems in automated food processing and packaging systems to automate sorting, grading, and packaging processes. Industrial automation and embedded systems are the key prospects for a mechatronics engineer. They are in high demand due to the emergence of IoT and a culture of fully automated manufacturing plants. Besides, many engineers are recruited solely as design engineers, and mechatronics students have expertise in this field.

Mechatronics engineering offers a unique advantage for students seeking diverse job opportunities in engineering companies, software houses and machine learning firms. For instance, computer science students excel in analytical skills and computational problem-solving, whereas mechatronics engineers possess comprehensive knowledge of mathematical subjects, real-world problem-solving, as well as fundamental computer science courses. Particularly, their expertise in fields like Machine Vision, Machine Learning, and Intelligent Systems makes them highly sought-after candidates in ML-based firms. Notably, mechatronics engineers stand out from other engineering disciplines like mechanical, electrical and computer engineering due to their ability to integrate hardware and implement software effectively.

Agricultural Sector

As an interdisciplinary field capable of developing advanced systems and machines, it has tremendous potential to reform the agricultural sector. For instance, mechatronics technology is used to develop precision irrigation systems that optimize water usage and reduce waste, to develop autonomous vehicles that run on renewable

energy sources, and to develop automated planting and harvesting machines that can work faster and more efficiently than human labour. By integrating sensors and machine learning algorithms, farmers can also monitor their animals' health and activity levels in real-time, identify potential health issues early, and take action to prevent disease outbreaks among livestock. As the world population continues to grow, the demand for food will increase, and mechatronics technology will be an essential tool to meet this challenge.

Research and Further Studies

A mechatronics mindset can significantly impact a researcher's thought process by encouraging them to approach problems from a multidisciplinary perspective, consider different design solutions, promote a systems-based approach to problem-solving, leverage new and emerging technologies, and promote a collaborative research approach. After graduating with a mechatronics degree, one can find many research areas for further studies, such as control systems, artificial intelligence and intelligent systems, human-machine interaction and collaboration, bio-mechatronics, soft robotics, biomimetic robotics, Micro and Nano-electromechanical systems (MEMS/NEMS), and much more.

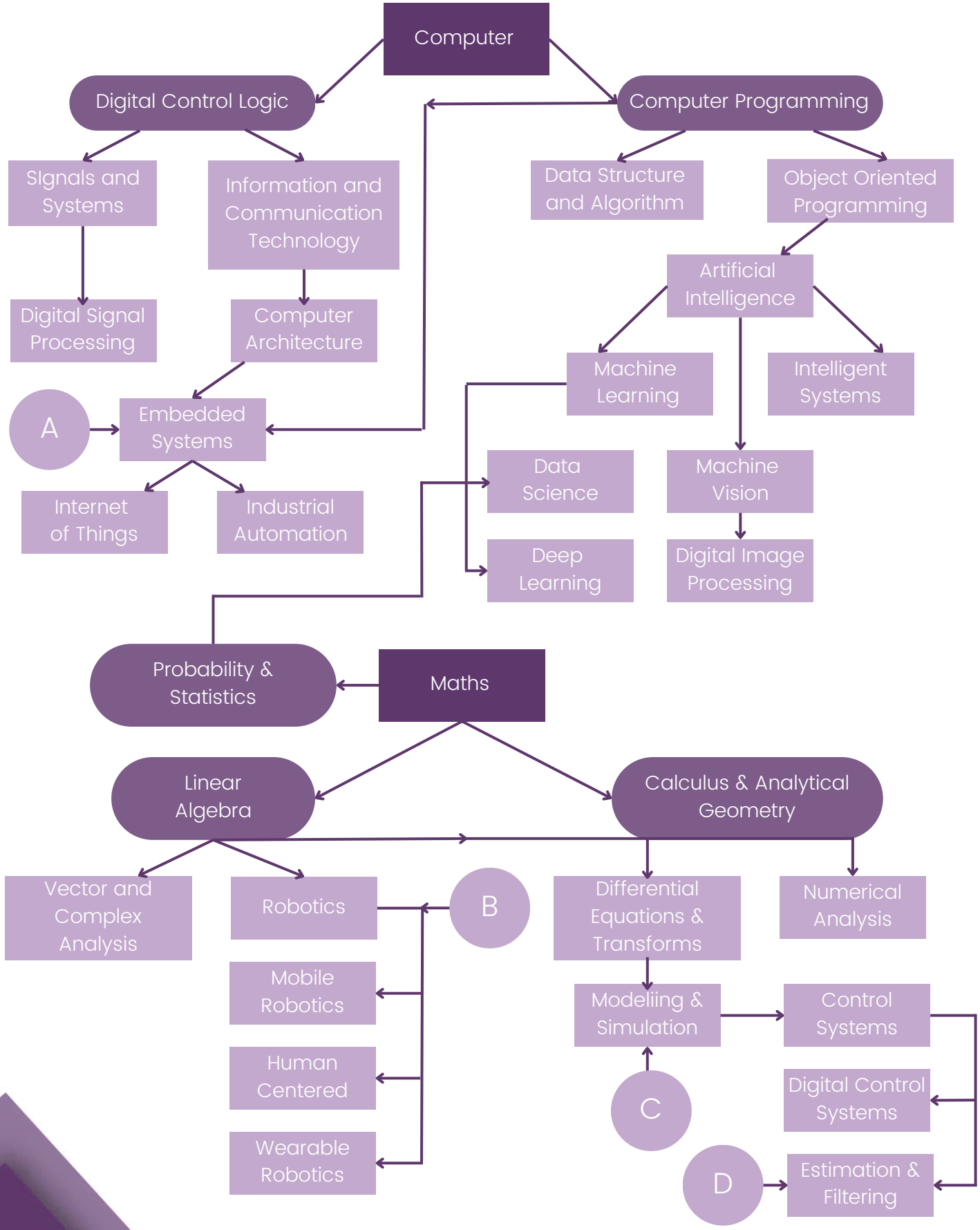
Government R&D

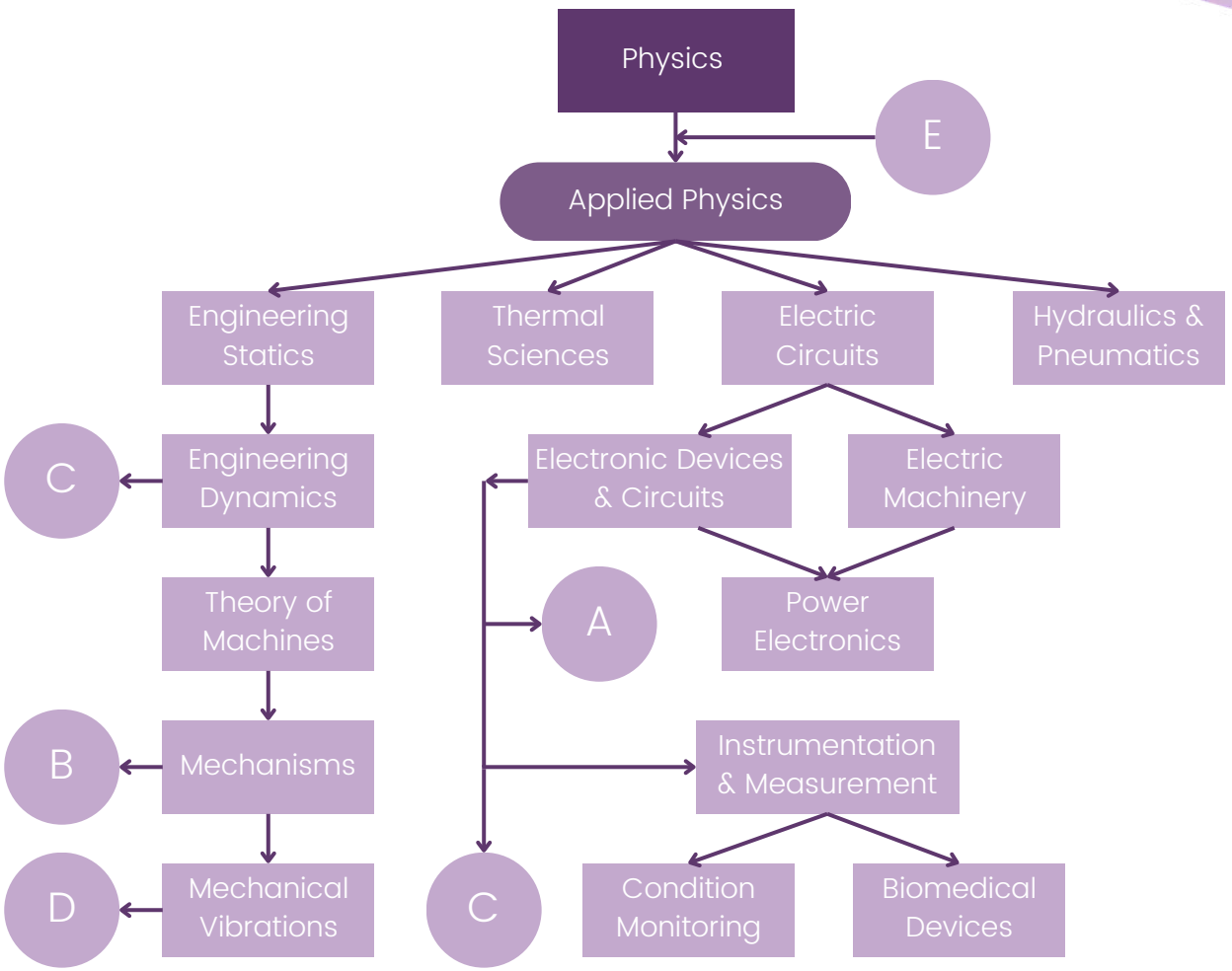
Government can promote innovation, economic growth, better healthcare, and national security by investing in mechatronics Research and Development. For example, in the defense and aerospace industry, mechatronics engineers work on developing unmanned vehicles, surveillance systems, and advanced weapon systems. While in the transportation industry, mechatronics engineers are involved in designing and developing autonomous vehicles and smart transportation systems. Moreover, in the healthcare industry, mechatronics engineers are involved in developing advanced medical devices, robot-assisted surgery systems, and prosthetics devices.

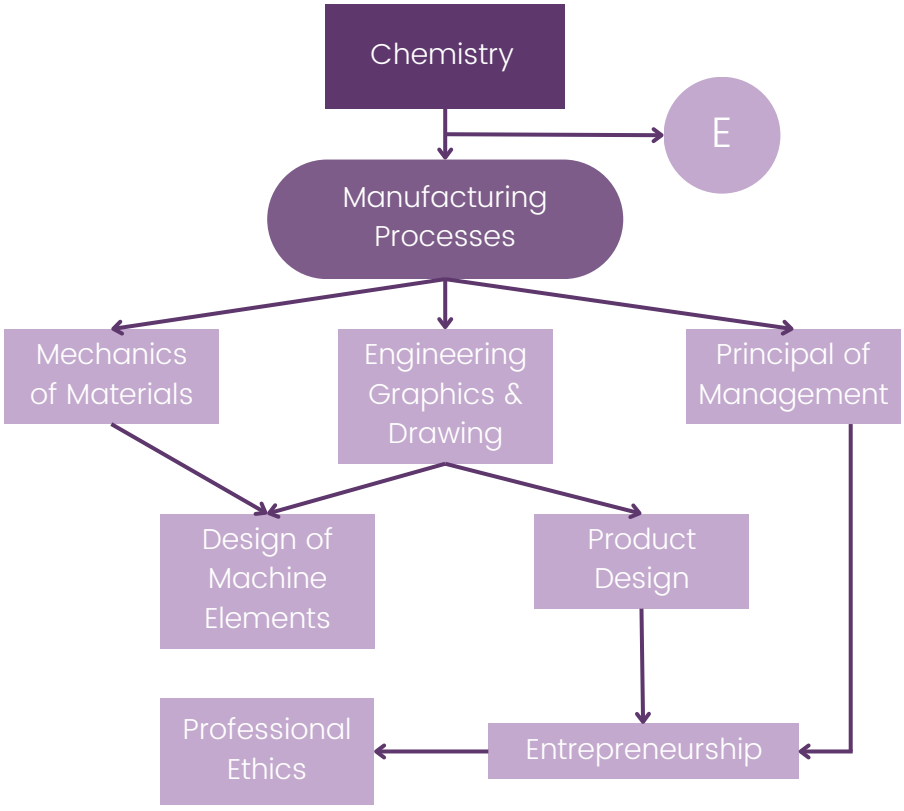
Entrepreneurship

The development of smart manufacturing systems, the Internet of Things (IoT), and artificial intelligence (AI) has created new opportunities for entrepreneurs to develop innovative solutions and technologies, such as autonomous vehicles, smart drones (UAVs), fitness trackers, surgical robots and home automation. Meanwhile, entrepreneurs with a background in mechatronics engineering can leverage their expertise to develop new products, systems, and technologies that can solve real-world problems or improve existing processes. For example, they can develop robotics or automation solutions to increase productivity, reduce costs, and improve safety in various industries, such as manufacturing, healthcare, or transportation. Mechatronics can also be used to improve manufacturing processes. Entrepreneurs can streamline their operations and reduce costs by automating tasks, optimizing performance, and monitoring real-time production data. This can help entrepreneurs increase their profit margins and scale their businesses more effectively. Entrepreneurs can use sensors and machine learning algorithms to create personalized products and services that meet individual customers' specific needs and preferences. This can help entrepreneurs build stronger customer relationships and improve brand loyalty. Mechatronics entrepreneurs' expertise in machine learning algorithms enables them to contribute in sustainability and preservation, particularly in water management amid scarcity challenges.

Roadmap to Mechatronics Engineer




Physics
E
Applied Physics
Engineering Statics
Thermal Sciences
Electric Circuits
Hydraulics & Pneumatics
C
Engineering Dynamics
Electronic Devices & Circuits
Electric Machinery
Theory of Machines
A
Power Electronics
B
Mechanisms
Instrumentation & Measurement
D
Mechanical Vibrations
C
Condition Monitoring
Biomedical Devices


Chemistry
E
Manufacturing Processes
Mechanics of Materials
Engineering Graphics & Drawing
Principal of Management
Design of Machine Elements
Product Design
Professional Ethics
Entrepreneurship

Mechatronics Applications

Most of the products and devices we utilize in our everyday life are related to mechatronics and significantly impact convenience, safety, and lifestyle. For some people, Mechatronics might be new terminology to learn, but the applications of mechatronics have always been there. We are unknowingly surrounded by things that use Mechatronics Engineering basic concepts. Only few of them are documented here.

- Incorporated into household appliances such as washing machines and dishwashers, mechatronics enables seamless automation. Washing machine sensors detect the presence of clothes, prompting precise water filling and automatic soap and detergent addition, ensuring efficient and hassle-free laundry.
- Refrigerators also make use of mechatronics and thermodynamics. By employing temperature sensors and smart control systems, they maintain a cool interior to preserve food and prevent spoilage. Additionally, it finds applications in various measuring devices, including testing sensors and calibration devices. Mechatronics has led to groundbreaking advancements in home appliances, offering convenience features like automatic milk ordering in refrigerators, text notifications from washers, and smart vacuums capable of transporting items. Moreover, mechatronics contributes to everyday gadgets, such as smartphones, enhancing user experiences through features like advanced camera functionalities. These innovations highlight the significant impact of mechatronics on modern living standards.
- The advent of anti-lock brakes and stabilization, airbag inflation, and fully autonomous vehicles are all applications of Mechatronics and are responsible for saving thousands of lives. For example, the ABS or anti-lock braking system is integrated into a vehicle that helps the driver stay safe while driving, even on slippery roads. The vehicle's wheels will not be locked even if the driver brakes suddenly with the ABS technology. Even the U.S. Postal System is testing autonomous trucks to deliver the mail.
- ABC or Active Body Control is an advanced suspension technology system that can dampen the car in all road conditions. It uses hydraulics to reduce enormous pressures and conventional shock absorbers to overcome small pressures.
- The motor management system is an integrated system that controls the entire performance of the machine and is controlled by a single device called an electronic control unit or contents. In this way, the machine can be controlled and always in the best performance because the data on the machine is computerized very sophisticatedly. In this technology, all machine components utilize sensors as inputs which will then be processed in the electronic control unit.
- Turbulence is one of the most common terms encountered in the aviation sector and is already familiar. Turbulence itself should not be ignored and underestimated because it can cause various dangerous events. One of the positive impacts of mechatronic technology is the creation of comfort in turbulence system technology, where the system functions to minimize the impact of turbulence, which can increase the comfort of passengers.

Mechatronics & Emerging Technologies

The maxim "opportunities emerge when ideas merge" thoroughly captures the soul of mechatronics. This arena thrives on the amalgamation of diverse technologies, which open up a world of possibilities for innovation and progress. The combination of electromechanical and computational sciences principles leads to the conception of innovative systems that can sense, process, and actuate physical processes with meticulousness and pace. Mechatronics currently encompasses vast domains of robotics, MEMS, and bio-medical systems making breakthroughs in medicine, agriculture, automation, aerospace, and space exploration.

Current Challenges

However, mechatronics and related domains confront challenges and hurdles that must be prevailed to realise their full potential. One of the foremost concerns in this regard is the susceptibility of interconnected systems to cyberattacks. Malicious individuals might hack teleoperated robots, resulting in lethal consequences, primarily when the robotic systems are engaged in medical or security-related functions. However, in cooperation with others, mechatronics engineers are developing communication protocols that rely on sound waves to exchange information between devices, thereby minimising cyber-attack hazards, not only in robotic systems but will contribute towards safety in other connected areas.

The industrial and transport sector contributes a substantial proportion of the world's energy consumption and greenhouse emissions, which is a primary concern globally relating to emerging technologies. By developing energy-proficient mechatronic systems, industries can moderate their reliance on non-renewable energy sources, decrease their carbon footprint, and increase their overall sustainability. One area of MEMS that offers a solution to this challenge is energy harvesting through electromechanical principles like the piezoelectric effect, allowing the capture of energy from stray mechanical vibrations and movements of industrial floors and motors. Also, energy-efficient solutions such as robust control systems can optimise energy use in industrial processes. The development and use of certain materials, using the knowledge of mechanical and electronics domains, can also serve this cause. Moreover, fuel consumption can be positively reduced through regenerative braking systems in automobiles. Similarly, developing advanced driver assistance systems and adaptive cruise control systems based on machine learning algorithms can avoid unnecessary braking and accelerations, subsequently condensing energy draining.

Imparting knowledge and skills to individuals through leading-edge technologies is an additional challenge. Most of the time, the equipment is complicated, expensive, and difficult to configure. Implements, such as Augmented Reality (AR)and Virtual Reality (VR), can facilitate learning. Both AR and VR, involving ML algorithms based on the detection of the orientation and position of the user in space, are mechatronic technologies. Moreover, Artificial intelligence (AI) interactive tools can easily demonstrate novel methodologies to learners. Simulation software is being reinforced through ML to perk up the simulations vital for developing any modern system.

A recent cropout challenge to mankind is the consequence of AI itself, named Deepfake Technology (DT). DT poses significant threats to global institutions, businesses, politics, and judicial systems. For the following reasons, they used to defraud businesses and raise cybersecurity concerns to organizations. They can also be used as a source of misinformation in politics and the court of law. A recent study revealed that digital forensics could provide an effective solution for detecting deep fakes. Using computational techniques, forensics experts can observe whether image pixels have been altered, by isolating anomalies, such as shadows and reflections.

The subject would be complete with a discussion of a recent technology ChatGPT which also poses a challenge to society, especially educational institutes, content writers, and programmers. However, a solution to this also exists; now, many AI tools are available to detect whether the text produced was AI-generated. These tools are extensively used to assess students in multiple testing systems and detect plagiarism.

Future Horizon

While it is impossible to predict the future with certainty, Mechatronics will most likely be perceived as the Deuteronomy of engineering and technology. Xenobots, a blend of synthetic biology and robotics reinforced by computer algorithms, will accomplish chores ranging from minimally invasive surgeries and intra-cellular examinations to pollution control and genetic engineering in agriculture. Electroencephalography, supported by AI methods, will assist in studying psychological behavior patterns. Smart cities will rely on automation, AIOT, aerial mechatronics and machine vision, and robotics for intelligent control of traffic, maintenance energy, waste management, and the development of smart buildings. For agrarian tasks, seeders, fertigation, and harvesters will be integrated into a single robotic line, multiplying productivity and precision with decreased environmental impacts.

It can be concluded that with continuous research, development, and improvement and keeping in view the principle of using technology for the welfare of humanity, Mechatronics, no doubt, is one of the most versatile, innovative, and evolving disciplines.

Mechatronics Department

With an aspiration of developing individuals who influence the world, Mechatronics & Control Engineering was adopted as a discrete bachelor's degree program in 2001 to acclimatize to the needs of the rapidly advancing world. Back in 1999, mechatronics was offered as a postgraduate degree program at UET Lahore. The Department of Mechanical Engineering supervised the program. After its evolvement, the degree program was assigned a distinct study area in 2005: the Department of Mechatronics & Control Engineering (DMCE). Since 2005, the department has catered to the need for engineers and researchers in the Mechatronics domain. The department has successfully delivered several projects of Artificial intelligence. It has enhanced the concept and use of robotics and automation to substitute human labor and facilitate production.

PUBLICATIONS OF THE YEAR 2022-2023

Sr. No	Authors	Title	Journal /Conference	Year
1	Zafar, B, Naqvi, S.A.Z., Ahsan, M., Ditta, A, Baneen, U., & Khan, M.A.	Enhancing Collaborative and Geometric Multi-Kernel Learning Using Deep Neural Network	Computers, Materials & Continua / USA	2022
2	Aftab, H., Baneen, U. and Israr, A.	Experimental Investigation of a Breathing Crack in a Plate under Different Excitations	Structural Control and Health Monitoring, UK	2022
3	Ayisha Nayyar, Ummul Baneen, Muhammad Ahsan, Syed A Zilqurnain Naqvi, Asif Israr	Damage detection based on output-only measurements using cepstrum analysis and a baseline-free frequency response function curvature method	Science Progress	2022
4	Muhammad Abdullah Sheeraz, Muhammad Sohail Malik, Khalid Rahman, Hassan Elahi, Muhammad Khurram, Marco Eugeni, Paolo Gaudenzi	Multimodal piezoelectric wind energy harvester for aerospace applications.	International Journal of Energy Research	2022
5	Naeem, Awais; Rizwan, Mohsin; Maqbool, Hafiz Farhan; Ahsan, Muhammad; Raza, Ali; Abouhossein, Alireza; Dehghani-Sanij, Abbas Ali;	Virtual constraint control of Knee-Ankle prosthesis using an improved estimate of the thigh phase-variable	Biomedical Signal Processing and Control	2022

6	Mazhar, Rashid; Hamid, Tahir; Raza, Ali; Ali, Wasif;	P063 A mechatronic bio-mimicking simulator to study various combinations of mechanical compressions during CPR.	Resuscitation - ERC Conference	2022
7	Bilal, Muhammad; Rizwan, Mohsin; Maqbool, Hafiz Farhan; Ahsan, Muhammad; Raza, Ali;	Design optimization of powered ankle prosthesis to reduce peak power requirement	Science Progress	2022
8	Zubair, Muhammad; Ishaq, Hafiza Nida; Raza, Ali; Maqbool, Hafiz Farhan; Zafar, Saqib;	Development and evaluation of a low-cost data acquisition system using heterogeneous sensors	International Journal of Sensor Networks	2022
9	Bakshi M.S., Rizwan M., Khan, G.J.	Design of a novel integrated microfluidic chip for continuous separation of circulating tumor cells from prephiral blood cells	scientific reports	2022
10	Muhammad Zia Ur Rahman, Rabia Liaquat, Mohsin Rizwan, Carlos Martin-Barreiro and Vitor Leiva	A Robust Controller of a Reactor Electromicrobial System Based on a Structured Fractional Transformation for Renewable Energy	Fractals and Fractional	2022
11	Bilal M., Akram M. N., Rizwan M.	Adaptive Variable Impedance Control for Multi-axis Force Tracking in Uncertain Environment Stiffness with Redundancy Exploitation	Control Engineering and Applied Informatics	2022

Memorandum of Understanding (MoUs)

The MOU aims to establish a framework for academic and research collaboration between the Parties in the field of Mechatronics. The Parties intend to promote the exchange of knowledge and expertise and to enhance the quality of education and research in Mechatronics.
Here are the Major Collaborations of our Mechatronics Department:

HUMAN-CENTERED ROBOTICS LAB (HCRL)

The recent major achievement of DMCE is to win a significant grant (worth 84 Million PKR) to establish a state-of-the-art lab for the National Center of Robotics and Automation (NCRA). This grant was awarded after a country-wide invitation of proposals, followed by screening and two rounds of presentations at HEC headquarters. This lab is named Human-Centered Robotics Lab (HCRL) and aims to develop industrial-grade robotic manipulators, exoskeletons, and active prostheses. The NCRA itself is a multi-lab establishment spread all over the country.

The lab focuses on research and development in the following sub-domains:

- Collaborative Robots
- Exoskeletons
- Active Prosthetics

The HCRL has established links with the following industries and healthcare units to ensure that robotic applications are developed to solve industrial problems. A few other links are also in place.

➔Ashraf Group of Companies
➔Stylers International Ltd.
➔Interloop Ltd.
➔Shalimar Hospital
➔Pakistan Society of Rehabilitation of the Disabled.

IHYA LAB FOR MECHATRONICS RESEARCH IN RESUSCITATION SCIENCES

The research lab has been recently established by the Department of Mechatronics and Control Engineering in collaboration with Hamad Medical Corporation Qatar. This lab aims to develop smart and marketable mechatronics devices which aid in resuscitation practices, in and out of hospital settings, thus saving the precious lives of the patients. It also aims to become an innovation hub in resuscitation sciences. Currently, the lab focuses on developing newer CPR machines and associated biomedical devices.

VIBRATION-BASED STRUCTURAL HEALTH MONITORING

Structural health monitoring (SHM) is the procedure of defining and applying damage and a damage identification strategy for aerospace, civil, and mechanical engineering structures. The research group has achieved excellent results in detecting and localizing multiple damages of less severity in beams and plates. These results are achieved without using data on the healthy structure. The work is successfully expanded to exclude the information on excitation force.

Currently, the developed methodologies are investigated for 2D structures. The potential use of this research is in all applications where information about the healthy structure and input excitation force is unavailable: hence the methodology can be implemented in all existing structures. Another dimension in this research is identifying damage and estimating its severity by considering the nonlinear nature of cracks. The research is being expanded to curved plates representing the structure of pressure vessels, submarines, boilers, etc. For experimentation, an MoU with IST Islamabad has been signed, and their facility is being utilized to validate the results.

INDUSTRIAL AND ACADEMIC LINKAGES

The academic section has also initiated multiple linkages with different industries and organizations, mainly to provide mechatronic solutions to their problems and meet their needs. We have established several academic linkages as well. A few of these attempts resulted in the signing of MoUs.

Active MoUs

STYLERS INTERNATIONAL LTD.

Recently, the department has signed this MoU with Stylers International Ltd., offering robotics and automation services to them, such as:

Project Domain 1: Development of automation solutions involving mechatronics, pneumatics, AI, and allied technologies.

Project Domain 2: Development of material handling systems, including Automated Guided Vehicles (AGVs), Robotics, etc.

Project Domain 3: Development of different solutions to meet sustainability goals, energy/resource conservation, worker fatigue minimization, etc.

MADE FOUNDATION (USA)

The department has initiated a collaboration with MADE Foundation USA to support a student competition encapsulating different areas, ranging from computer-aided design to autonomous navigation in unstructured scenarios. Up till now, two competitions have been conducted by the department.

WORLD-TWIN PROGRAM

UET and THWS International (University of Applied Sciences Wurzburg- Schweinfurt) signed a letter of intent in 2021 to cooperate on the project "HAW. International Module B-FHWS World -TWIN".

The World-Twin project is particularly about Robotics and will provide a platform where partner universities can share their ongoing projects and research related to robotics. The main features of this programme include:

1. Harmonization of curricula (comparison of the curriculum developed for the programme on robotics at FHWS).
2. Internalizing mandatory internships and creating a multinational internship program; expanding the networking activities with domestic and foreign partners.
3. Expanding mobility (physical and virtual) regarding all university members; students, lecturers, employees and various short-term programs.

In this context, the delegation of 5 students and 1 supervisor of the Mechatronics Department has participated in Robotics exchange week at THWS, Germany. The partner universities (Taiwan, Austria, Jordan, and China) shared their curriculum with THWS for comparison.

MOU WITH STYLE TEXTILE

In this MoU, it was agreed that the department would develop automation solutions using its R&D facilities to improve quality and productivity at Style Textiles. UET will charge a suitable fee. These solutions are expected to generate a positive impact, directly or indirectly, on the Pakistani garment industry. The following are the two projects initially agreed upon:

- Development of Automated 3 stripe Attachment with Auto-Loading and Disposing.
- Development of Automated UPC Bar-Code Scanning on a Metal Detection Machine.

MOU WITH THE DEPARTMENT OF MECHANICAL ENGINEERING (DME), INSTITUTE OF SPACE TECHNOLOGY (IST) ISLAMABAD

The primary purpose of this MoU is to ensure the communication and coordination necessary to implement research/educational projects agreed upon by the Parties. Secondly, this agreement makes research facilities and equipment available for both Parties to carry out their undergoing and future projects more effectively. Initially, the following research areas have been identified and agreed upon for collaboration between the two Parties:

- Damage identification of nonlinear breathing cracks under different excitations using experimental measurements — DMCE-UET *(Completed successfully)*
- A baseline-free output-only vibration analysis technique for structural damage detection using experimental measurements – DMCE-UET *(Completed successfully)*
- Design and development of active prosthesis hand – DME-IST
- Undergraduates and Graduate projects related to Robotics and Controls – DME-IST

Completed MoUs

MOU WITH HUANENG SHANDONG RUYI PAKISTAN LTD. (HSR)

This MoU has been signed at the university level and was aimed at training the graduate engineers of HSR for their 1320MW Coal-fired Power Plant at Sahiwal. The following module was developed and constructed by the department:

- Coordinated Control for Power Units Technology and Systems

MOU WITH PETROSEL LUBRICANTS (PETRONAS)

In this MoU, it was desired to enable selected students of UET by involving them in an engineering competition duly sponsored by Petrosel Lubricants (sole representative of Petronas Lubricants in Pakistan). Additionally, it was desired to create a professional environment to share ideas.

Students Project Competition was held in the following two categories:

- Run-of-the-river turbine design
- Power-assisted-bicycle design

Funding Support: PKR 10 Lacs + Malaysia Visit; PKR 30k per team was provided as the seed money to 5 teams; 1 Lac per competition + 5-day fully sponsored visit to Malaysia for winning teams.

MOU WITH TETRA PAK PAKISTAN

The department also signed an MoU with Tetra Pak Pakistan to train field service engineers in various technologies. This was an international assignment, spanned over two years, in which the department conducted 7 training sessions and generated PKR 9Million in revenue. Each session was comprised of the following modules:

- Programmable Logic Controllers (Allen Bradley SLC 5000)
- Hydraulics and Pneumatics
- Sensors and Actuators
- Motor Controls
- Processing Techniques

Other Collaborations

WITH TAIWAN TECH

Prof. Jerry Lin (former Chairman Mechanical Engineering Dept. of Taiwan Tech.) visited the department to establish collaboration between the two institutes. As a result of this visit, selected students were offered scholarships to pursue a graduate degree at Taiwan Tech. The university also invited one of our faculty members to visit their facilities and deliver a research talk.

WITH LUMS

Both institutions agreed on mutual collaboration for developing solutions and technologies within the domain of expertise of participating departments that are needed for the country. They also agreed to grant access to Biomechanics Lab at LUMS and Robotics Lab at UET reciprocally. Mainly the following projects were identified for collaboration:

- Project Title: Wearable Embedded Instrumentation for Cricket Bowling Analysis
- Project Title: Investigation of Shoulder Movement during Cricket Bowling: Comparing Marker-base and Marker-less MoCap Approaches.

WITH HONAM UNIVERSITY KOREA

1. Capstone Design Project:

- Electric Scooter Design: Students were assigned the project to develop a two-wheel self-balancing scooter. A similar project was also assigned to a student group in the sister university. It was desired that the students would mutually develop the project.

2. Hybrid Drone (for Agriculture Application):

- A proposal to spray pesticides using a hybrid drone was drafted.

Featured Projects

1. SURVEILLANCE DRONE FOR SEARCH OPERATION

Group Members:

- M. Talha (2019-MC-02)
- Hafiz M. Irfan (2019-MC-04)
- Ali Hamza (2019-MC-24)

Project Summary:

Unmanned Aerial Vehicle (UAV) terms are very familiar to the world. UAVs are aircraft or drones or Hexacopter that are either controlled by a man or are aerial self-control vehicles. First, UAVs were used only for military purposes for their surveillance, policing, and security purpose, but now the industry of UAVs is flourishing rapidly. This Project is also one application: a Hexacopter for surveillance purposes with machine learning techniques and ArduPilot (Pixhawk), Arduino, a GPS module that takes location from GPS and chooses its path to reach the destination.

The Surveillance Drone for Video Transmission is a final-year project designed to address Pakistan's increasing demand for efficient and effective video surveillance. The drone is equipped with TS832 and RC832H with FPV cameras for real-time video transmission, enabling users to monitor remote locations and capture live footage. The project aims to provide a cost-effective and sustainable solution to video surveillance challenges in Pakistan, particularly in areas that are difficult to access or monitor using traditional methods. The project aligns with the United Nations' Sustainable Development Goals by promoting innovation, technology, and sustainable development in Pakistan. Future recommendations include:

- Improvement in the drone's flight time and range.
- To enhance its sensor technology.
- Exploring opportunities to apply it to other fields, such as agriculture and emergency services.

2. VISION BASED HIGH SPEED SORTING

Group Members:

- Asad Raza (2019-MC-13)
- Haseeb Ahmad (2019-MC-25)
- Dawood Imtiaz (2019-MC-27)

Project Summary:

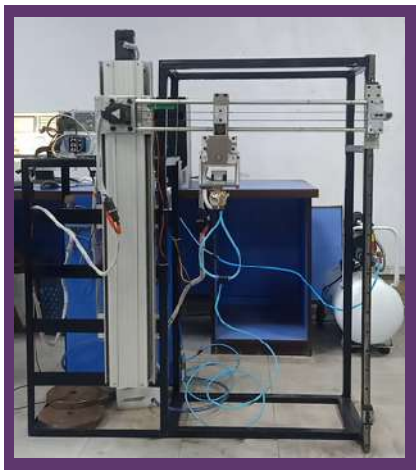
The project aims to design a segregation system for carton boxes of various items on a fast conveyor using a printed pattern on top of them. The approach of the system is split into two sections:

1. Detection
2. Sorting

A Raspberry Pi CPU and an industrial-grade Machine Vision camera are coupled, and the Raspberry Pi scans the ArUco marking on the carton box and sends a signal to the PLC (programmable logic controller). The conveyor extension has a pneumatic cylinder attached, and a PLC controls the solenoid valve. The cylinder will actuate in response to the Raspberry Pi signal, pushing the carton box toward a workstation or a sub-conveyor.

The developed system has more than 94% accuracy with a linear speed of 1m/s of the conveyor belt, which is considered high-speed in industrial sorters and can be increased further. Currently, 3 sortings are being done. The system is now ready-to-use in any packaging industry; once the high-speed detection technique on the conveyor systems is implemented. Such systems are used in FMCG and warehouses like Daraz, where they precisely sort carton boxes and reduce non-operational time and effort.

3. AUTO SPRAYER



Group Members:

- Abdullah Khan (2019-MC-11)
- Muhammad Ibrahim (2019-MC-32)
- Maesha Ijaz (2019-MC-35)

Project Summary:

Painting robots are increasingly used in industries to apply paint, offering a solution to the challenges associated with manual painting processes. Traditionally, painting in industries such as textiles and furniture has been done manually, leading to inconsistencies in paint distribution due to human errors, defective products, reduced production rates, significant paint wastage, and human fatigue during repetitive tasks. Moreover, manual painters face health risks due to prolonged exposure to paint and hazardous substances. To address these issues, automated paint robots provide an efficient and consistent alternative. These robots apply paint and handle various coatings, including specialized options like anti-fingerprint coatings. The objective is to develop an automatic Cartesian spray paint robot that ensures minimum human involvement, uniform paint distribution, and delivers high-quality finishes.

The spray paint robot's mechanical design was created using SolidWorks, allowing for a detailed 3D model and thorough testing before manufacturing. The robot, controlled by Mach3 software, demonstrated high accuracy and precision in movements, resulting in consistent and uniform paint coatings. The hardware components, such as spray nozzles, motors, sensors, microcontrollers, and pumps, were successfully integrated to create a fully functional spray paint robot.

The body of the robot, designed to be compact, durable, and easy to use, met the desired expectations. Its application extends to various industries requiring painting operations, including textile, furniture, automotive, automobile spare parts, aerospace, and manufacturing. The efficient performance of the spray paint robot will improve productivity and reduce labor costs revolutionizing painting processes and contributing to the growth and efficiency of industries.

4. PATH PLANNING AND NAVIGATION OF KOBUKI BASE USING ROS

Group Members:

- Muhammad Ahmed (2019-MC-23)
- Qasim Saleem (2019-MC-26)
- Syed Faraz Ali (2019-MC-30)

Project Summary:

This FYP was focused on path planning and navigation for a mobile base, specifically the Kobuki Turtlebot2, using the Robot Operating System (ROS). Incorporating a Kinect RGB 3D depth camera for Simultaneous Localization and Mapping (SLAM) enhances the robot's perception capabilities.

One of the project's key achievements was implementing the A* algorithm, combined with the navigation stack's move_base package, to enable the robot to find optimal paths from a starting point to a target destination. This allowed for efficient and effective navigation within the environment.

The robot's ability to navigate while avoiding static and dynamically moving obstacles was a notable aspect of the project. This required implementing obstacle detection and avoidance mechanisms to ensure safe and obstacle-free traversal.

Overall, the FYP successfully demonstrated the integration of path planning, SLAM, and obstacle avoidance techniques, resulting in a capable and intelligent mobile robot that could navigate autonomously in real-world scenarios.

5. IMPLEMENTATION OF CONTROL ON A BALL-BALANCING ROBOT

Group Members:

- Muhammad Amaan Majid (2019-MC-48)
- Raja Haseeb Ahmad (2019-MC-69)
- Noor-ul-Huda (2019-MC-72)

Project Summary:

This Final Year Project was focused on implementing control on a ball-balancing robot. The objective was to develop a robot capable of balancing a ball on a platform using control algorithms. The project used a NI myRIO 1900 microcontroller to leverage feedback control concepts. The robot's movements were optimized to maintain balance by processing sensor data and applying an LQR (Linear Quadratic Regulator) controller. A Kalman filter was also implemented to reduce sensor noise and improve accuracy. The ball-balancing robot successfully achieved its objective through extensive experimentation and software development. It demonstrated the ability to balance the ball on the platform, even in external disturbances. The performance and accuracy of the robot were significantly enhanced by using the myRIO controller's advanced processing capabilities. Overall, the project showcased the application of control systems engineering principles in developing a ball-balancing robot. It highlighted the importance of implementing advanced control algorithms and utilizing powerful microcontrollers for improved performance and stability. The project's success opens up possibilities for various industrial applications, such as manufacturing automation and robotic assistance.

Accreditation Visit

Accreditation is a process of quality assurance through which a program in an approved institution is critically appraised at intervals not exceeding five years to verify that the program meets the norms and standards prescribed by the PEC EAB from time to time. The BSc program in Mechatronics & Control Engineering has been accredited by the Pakistan Engineering Council (PEC) since its first session. The next visit is due in 2023 for the accreditation of sessions from 2019 onwards.

STRENGTH OF PROGRAM

The primary strengths of the program are summarized as under:

- The undergraduate program is one of the oldest in Pakistan (started in 2001).
- The program has a multi-disciplinary composition keeping pace with the modern developments in the field.
- Diversity: the average class is observed to have a healthy urban-rural balance and a good gender balance. Thus, the program reflects the true spirit of diversity in Pakistan.
- The department provides significant seed money to students working towards their final year projects.
- The students have successfully participated in several national-level competitions.
- The alumni reflect the program's success in industry and academia.

The undergraduate program was successfully accredited under the OBE system in 2017 (for sessions 2013 and 2014). Re-accreditation under the OBE system was granted for all the subsequent sessions, i.e. 2015 to 2018.

Tutorials

Recognizing that a well-rounded education involves more than just classroom learning, the university offers a range of support services to ensure that the students thrive in all aspects of their lives. Student counselling for matters other than academics is available, aimed at addressing various challenges that students may face during their time here. The department has a dedicated tutor/mentor for each session, who arranges regular mentoring sessions to help students overcome their financial, psychological, and emotional predicaments.

Moreover, a full-time psychiatrist remains available in the university health clinic, and the humanities department arranges special lectures/short courses during the summers. The psychiatrist's contact details and available timings have been displayed on the department notice board. Moreover, this information is also circulated among students via social media.

Departmental Achievements

Sr. No	Student's Names /Registration numbers	Event Name	Organizer/ Location /Conference	Achievement
1	Zainab Ishtiaq/ 2020-MC-19	2nd Future of Women in Energy Scholar Program	Texas A&M/ Qatar/ 2023	Got selected for the program
2	Awais Zafar /2020-MC-02	MITACS Globalink	Ontario Tech University/ Oshawa/ Canada/ 2023	Got selected for the Research Internship
3	Shaheer Ahmad Khan/2019-MC-34; Dawood Imtiaz/ 2019-MC-27; Waleed Raza/2019-MC-08; Usman Irshad Bhatti/2019-MC-07	SOFTEC 23	FAST NUCES/ Lahore/ 2023	3rd Position
2	Zainab Ishtiaq /2020-MC-19; Nimra Areeb Aisha/2020-MC-33	Neo '23 IEEE/ ROBOTHON	IEEE GIKI/ Swabi / 2023	Winner
3	Noor Sultan/2020-MC-46; Zainab Ishtiaq/ 2020-MC-19; Ibrahim Haroon/ 2020-MC-28; Fawaz Mehmood Mughal/ 2020-MC-26; Ali Sajid/ 2020-MC-64	WORLD-TWIN Program of FHWS International	FHWS/ Germany/ 2022	Got shortlisted for the German Exchange Program
4	Ali Sajid/2020-MC-64; Noor Sultan/2020-MC-46	UCP Olympiad 2022/ Project Exhibition module	Society of Mechanical Engineers (SME)/UCP/2022	Winner
5	Faizan Tanveer/2020-MC-62; Ali Sajid/2020-MC-64; Noor Sultan/2020-MC-46	UCP Olympiad 2022/ Mastermind module (Quiz Competiton)	Society of Mechanical Engineers (SME)/UCP/2022	Runners up

6	Abdur Rehman Sarwar / 2019-MC-65	LAGAN Competition	LAGAN/REMOTE/2021	3rd Position
7	Muhammad Hamza Waheed / 2021-MC-55	Kamyab Jawan Program 21(Squash Team UET)	National event/Islamabad/2021	Semi- finalist team
8	Shaheer Ahmad Khan/2019-MC-34	All Pakistan Inter University Naat Competition	University of Agriculture/ Faislabad/ 2021	Winner
9	Shaheer Ahmad Khan/2019-MC-34	All Punjab Inter University Naat Competition	Gov. of Punjab/ GCU Lahore/ 2021	Winner
10	2019-MC-34; 2019-MC-31; 2019-MC-12; 2019-MC-25	RoboThon'20/ Robo Arm competition	UOL ROBOTECH SOCIETY/UOL Lahore/ 2020	Runners Up
11	Saif Ullah Afzal/2019-MC-12; Shaheer Ahmed/2019-MC-34; Usman Tariq/2019-MC-31; Muhammad Ali/2019-MC-01	RoboThon'20/ RC Car	UOL ROBOTECH SOCIETY/UOL Lahore/ 2020	Runners up
14	Students of Session 2019	HI-ROBOFIESTA 3.0/ RC car competition	HITEC University Taxila/ 2019	3rd Position
15	Students of Session 2019	HI-ROBOFIESTA 3.0/ Robowars	HITEC University Taxila/ 2019	1st Position
16	Students of Session 2019	Airtech '19/ Robo Lines	Air University/ Islamabad/ 2019	3rd Position
17	Students of Session 2019	CODRED'19	COMSATS/ Lahore/ 2019	1st Position
18	Students of Session 2019	CODRED'19	COMSATS/ Islamabad/ 2019	Runner up
19	Students of Session 2018	CODRED'18	COMSATS/ Islamabad/ 2018	Winner

20	Students of Session 2017	Softech '17/ Robowars	FAST/ Lahore/ 2017	Runners Up
21	Students of Session 2017	Airtech '17/ Robowars	Air University/ Islamabad/ 2017	Runners Up
22	Students of Session 2017	LFR Competition	UET/ KSK/ 2017	Runners up
23	Students of Session 2020	IEEE Week/ LFR Competition	UOL ROBOTECH SOCIETY/UOL Lahore/ 2020	1st Position
24	Students of Session 2017	UCP Olympiad/ LFR Competition	UCP/ Lahore/ 2017	1st Position
25	Students of Session 2015	IST Youth Carneval	IST/ Islamabad/ March 2015	Overall Best Performance in Engineering Competitions
26	Students of Session 2015	National Engineering Robotics Contest 2015	NUST/ Rawalpindi/ September 2015	Best Engineering Design Award
27	Students of Session 2013	Technical Projects Exhibition & Competition	FAST/ Lahore/ March 2013	1st , 2nd Position
28	Students of Session 2012	Spades Robotic Race	LUMS/ Lahore/ April 2012	3rd Position
29	Students of Session 2012	Robomaze	GIKI/Topi Swabi/ November 2012	1st Position
31	Students of Session 2011	Robothon 2011	GIKI/ Topi Swabi / March 2011	2nd Position
32	Students of Session 2011	Naags Robotics Race	GCU Lahore/ Lahore / July 2011	1st, 2nd Position
33	Students of Session 2019	UCP Robotron 2019/ LFR Module	UCP/ Lahore/2019	1st Position
34	Students of Session 2019	UCP Robotron 2019/ Robowars	UCP/ Lahore/2019	1st Position

Made Foundation

Human-Centered Robotics (HCR) has been growing exponentially over the years. Developing safe and efficient solutions for interacting with humans and machines has become increasingly important. The Department of Mechatronics & Control Engineering, in collaboration with Made Foundation (USA), recently organized a competition on HCR in UET Lahore to discover and nurture the most talented students in this field. The competition was designed to encourage innovation and creativity among the participants. It was open to anyone interested in the field of HCR and had an innovative idea to offer. The competition was held in three rounds. In the first round, many participants registered their groups in the competition.

In order to create awareness and provide guidance about HCR, the Mechatronics Department's Chairman gave a seminar before the start of the competition. This seminar was attended by a large number of students who were interested in the field of HCR. During the seminar, the Chairman explained the core principles of human-centred design: inspiration, ideation, and implementation. The first principle of human-centred design is inspiration, which involves observing day-to-day problems and identifying areas where HCR solutions can be applied. The second principle is ideation, which involves brainstorming and developing the most efficient solutions with limited resources. The third and final principle is implementation, which involves turning ideas into practical solutions. The competition was a huge success, with the participants presenting many innovative and creative ideas.

The judges were impressed with the level of creativity and the quality of the ideas presented. The competition was organized in a way that allowed the participants to showcase their skills and talents while also allowing them to learn from each other. The competition was not just about winning the cash prize but also about learning and gaining experience. The participants had the opportunity to interact with professionals in the field of HCR and learn from their experiences. This was a valuable opportunity for the students to expand their knowledge and gain insight into the industry. The competition also helped raise awareness about the importance of HCR and its role in our daily lives. HCR is a field that has much growth potential, and students need to be aware of the opportunities available in this field.

In conclusion, the HCR competition organized by the Department of Mechatronics & Control Engineering, in collaboration with Made Foundation (USA), was a huge success. The competition allowed students to showcase their talents and creativity in the field of HCR. It also helped to raise awareness about the importance of HCR and the potential for growth in this field. The competition was a valuable learning experience for the participants, and it is hoped that similar events will be organized in the future to continue promoting and developing the HCR field.

Germany Tour

As I stepped off the plane in Germany, I could feel the excitement building in my chest. I was about to embark on a once-in-a-lifetime adventure, an opportunity to explore the world of robotics in one of the most technologically advanced countries in the world. I still remember strolling along the sidewalk in Schweinfurt during a gentle drizzle. The charm of the town struck me. The colourful buildings, intricate architecture, traditional German homes with thatched roofs, and cobbled streets left me captivated. It was a surprise to see the tradition of using bicycles as a common means of transportation by the locals but more of a surprise to see the city shut down at just 20:00. For me, used to the bustle of city life; it was a refreshing change of pace to contemplate the peacefulness around me. My base was the beautiful town of Schweinfurt, where I resided at the cosy and comfortable B&B hotel on a five-minute walk from the campus of FH|W-S. It was an eye-opener and an unforgettable expedition, delving deep into the heart of the university's breathtaking campus as I had the opportunity to explore the cutting-edge labs of the university, filled with state-of-the-art equipment, and learn about the groundbreaking research and development projects underway.

It was a wonderful experience attending the 50th-anniversary celebration of FH|W-S that was graced by the presence of the mayor and state minister of Bavaria. However, I cannot help mentioning Dr Abid Ali, the chairperson of the Mechatronics Department at FH|W-S, who invited us to his home for a delightful dinner of home-cooked cuisine. The delectable aromas and flavours of each dish were a true testament to the love and care that went into preparing them, which made us feel a sense of warmth and hospitality that would stay with us forever. As a picture says more than a thousand words, it was a truly magical experience to witness beauty and creativity while my visit to the George Schafer Museum, filled with a peaceful stillness and illuminated by the gentle glow of the gallery lights. A true gem of the local art scene, I would say.

Have you ever been to a cultural training? Well, I had one there. Imagine attending an intercultural training session in Germany with delegates from Taiwan, Jordan, and Austria. We played games that taught us about different cultures and participated in a scavenger hunt. The task was simple - we had to find pig statues scattered throughout the city and return within an hour. The catch was that the team that found the most pig statues would be declared the winner. Although I did not win, the experience was unforgettable. It was amazing to see the camaraderie between the delegates from different countries, all united in the spirit of fun and adventure. Industrial tours are a crucial part of university life, but an industrial tour to Schaeffler, the globally top-ranked bearing manufacturer, has its own irresistible charm. As I walked through the facility, the air was alive with the buzz and whir of machines.

The automated processes unfolding before my eyes were nothing short of fascinating. I watched in amazement as intricate mechanisms moved with hypnotic grace, communicating with each other in milliseconds to execute tasks flawlessly. Witnessing this futuristic world of perfect harmony between humans and machines left me in awe, and it left me with a newfound appreciation for the incredible manufacturing processes that make our modern world possible.

We all have heard the stories of ancient princes and their humongous royal residences. I was fortunate enough to visit Prince Bishop of Wurzburg in Germany. I stepped inside and was transported to a different era, surrounded by ornate decorations and intricate details that told the story of the region's rich history. It was a surprise to know that the ceiling fresco in the staircase of this residence is the largest in the world. It still feels so nostalgic to feel the warmth of the sun on my face and to enjoy a gentle breeze as it reminds me of the Sun bath I had while along the banks of the Main River at Wurzburg, marvelling at the city's stunning skyline and the reflections dancing on the water's surface and the refreshing breeze while watching the panoramic views of the city below from the mountain top of Mareinberg Fortress.

After my hike, I did some shopping and stumbled upon a quaint little ice cream parlour. The smell of freshly made waffle cones and the colourful display of ice cream flavours was irresistible. I chose my favourite flavour, the taste of which still dances in my taste buds, and it was the perfect treat on that warm day. A day in Wurzburg was full of adventure, laughter, and joy. I felt as if I had truly experienced a taste of German culture and would always hold the memories of that day close to my heart.

My scholarship in Germany was not only a great learning experience but also a culinary adventure. The Turkish Doner, Durum wraps, thin crust pizzas, fresh seafood, and refreshing drinks were all incredible. The explosion of flavours and aromas left a lasting impression on me. When I boarded the plane back to Pakistan with lots of memories and photographs, I felt a sense of gratitude and wonder at the experience I just had. The Robotics Exchange Week in Germany - what an unforgettable tour it was! One that has expanded my knowledge and understanding of robotics and culture and has enriched my life in ways I could never have imagined. It still pours my soul with surges of excitement and butterflies in my stomach when I recall.

- Written by Ali Sajid (2020-MC-64)

Final Year Tour

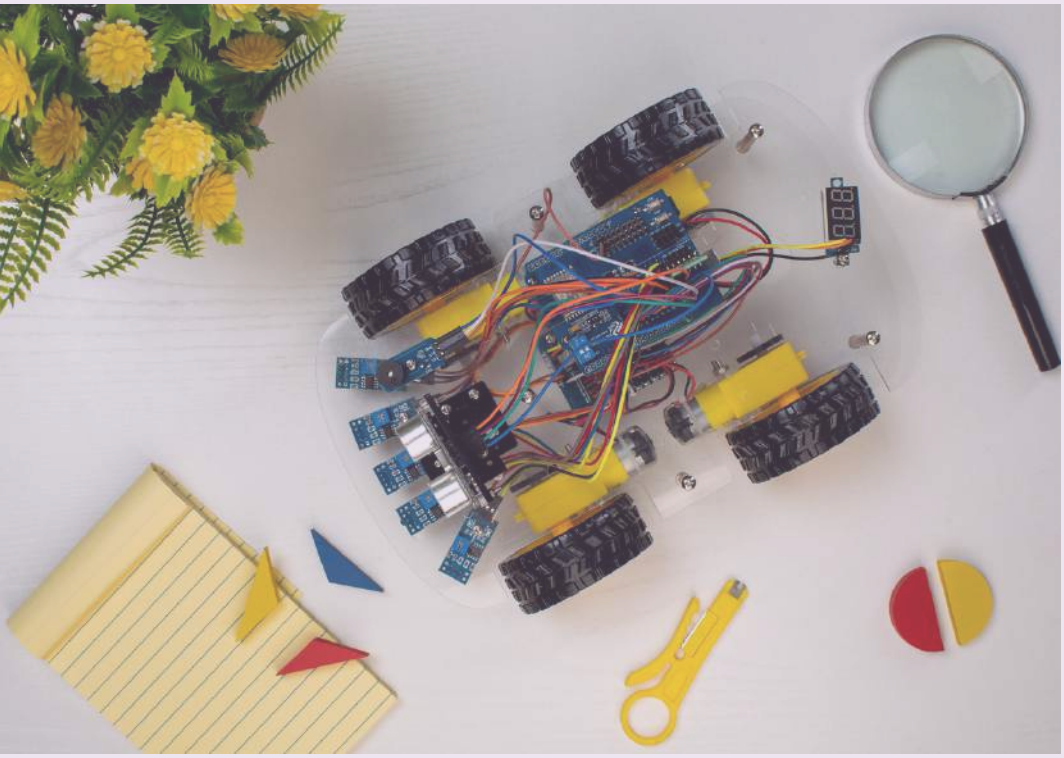
Our senior year tour started with us leaving Lahore on a foggy morning. We arrived in Abbottabad just when a fresh pour ended. We had dinner and rested before our first site visits the following day. The sites included Tops Juice and Murree Glass industries in Hattar Industrial State. We learned about the various roles of a Mechatronics Engineer in the production and maintenance sector. The on-site engineers provided valuable insights and guided us through the initial stages of a professional career in engineering. The long and tiring site visit was followed by a fish BBQ and a first try at chicken handi for dinner with the tour supervisors. The night ended with lots of fireworks and chocolates. We left for Tarbela Dam the following day and were in awe of the site, the largest dam in Pakistan, particularly the control room. And then, we visited Ghulam Ishaq Khan Institute of Engineering Sciences (GIKI), where we got to observe their Labs and the ongoing relevant projects. After a warm dinner, we returned to Abbottabad city and walked down the hill a few kilometres to the hostel.

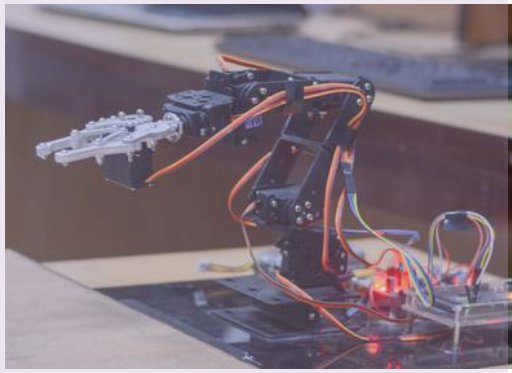
The day after, we reached Balakot in mild rainfall, where a renowned local delicacy breakfast awaited us. This was followed by a thrilling jeep ride uphill to Shogran, hidden under the snow. The sights were heavenly until we spent an hour of chaos trying to find cell phones buried in the snow. We started the descent as a snowstorm approached, followed by a cold return to the hostel in heavy rainfall. The thrill of this advent made us aim for a lighter time on the last day of our stay. We went to the Shimla Hills in pleasant weather and relished the picnic spot. We returned by the evening and ascended a hill next to the hostel with the supervisors to catch the sunset, but the rain said otherwise, and we had to go through another thrill descending in the dark. The last night we had us staying up late, sitting on the veranda, singing, chilling, gossiping and whatnot. One of the most unforgettable moments was the cosy bonfire we arranged on the porch of our accommodation. We did not sleep, nor did we let anyone sleep through that night. We left for Lahore early in the morning with a stop at the Murree Brewery site. We offered Jumma prayer at Sadar and got moving again. The travel back to Lahore closed to a warm time with the instructors.

- Written by the students of the 2019 session

Sports Week

Apart from the initiative, like tutorials that are focused on addressing the students' mental health. This year faculty of the Mechatronics department took the initiative to ensure students' physical health by organising the 'Sports Gala 2023'. The event revolves around promoting healthy competition among students and encouraging the importance of physical activities. Such recreational activities also relieve students from their hectic and monotonous routines. And that was quite evident with a large number of participants. This event was a huge success and was admired by everyone there. The week was dedicated to outdoor sports like Cricket, Football, and Tug of war and indoor sports like Badminton and Table Tennis. Teams of every section from each session have their own team striving to become the ultimate champions of Mechatronics. The tournament had many tough matches, indicating our students' extra-curricular potential. Not only students showed their participation, but faculty members as well.





MECHATRONICS CLUB

MECHATRONICS CLUB

Automating the Standards!

MECHATRONICS CLUB

EVENTS

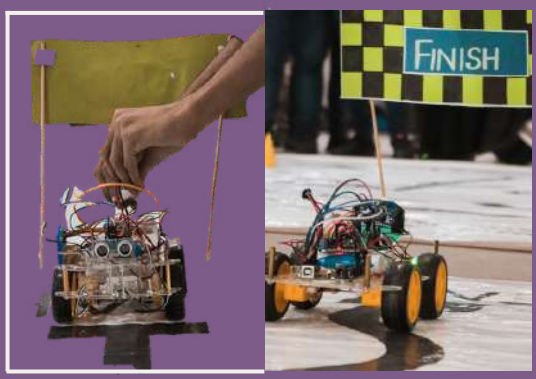
Mechatronics Club, a departmental society, has a legacy of delivering a high-quality learning and personal growth environment. The students are being facilitated to showcase their talent and aptitude through their innovative and analytical mindset. Our alumni have been a true motivation and exemplary for us throughout our engineering career. The following are some of the club's events.

TECHNICAL ACTIVITIES

The Mechatronics club motivates students to engage in technical activities to enhance their self-assurance and acquire practical knowledge in their preferred study area.

ROBOCOM

Technovation Week is the signature event of UET. Various inter and intra-university competitions, technical modules, and project displays from different departments are held each year. ROBOCOM, the biggest robotics competition arranged by Mechatronics Club, is also normally organized during Technovation Week. In ROBOCOM, everyone can network with peers while experiencing the most cutting-edge robotic contest and hardware available. It is an inter-university competition, having participants from all over the country. This year's ROBOCOM included Line Navigation & RC Car modules. This event brought together talented individuals from diverse educational institutions who share a common passion for robotics, fostering a healthy and stimulating environment, and nurturing a culture of innovation and continuous learning.



TECHNOWAR

To enhance and test students' engineering skills in CAD, Programming, and Electronics, Mechatronics Club arranged competitions under the name "Technowar." The competition comprised three major areas:

1. Code-war
2. Elektro-war
3. CAD-war

WORKSHOPS

Multiple workshops this year have allowed students to practice their practical skills in diverse domains, i.e., Deep Learning, PCB Workshop, Documentation Workshop, Proteus and Soldering Workshop, LNR, and RC car. This year's prominent workshops were Human-Centered Design Workshop and that with the collaboration of AKS UET: Media Workshop.

INDUSTRIAL TOURS

Mechatronics Club arranged the Industrial Tours for its members at Stylers International (Pvt) Ltd and SNGPL. Club members visited the industry and explored different departments. They observed major manual and automated operations in Stylers, including sewing, cutting, packing, stamping, laser engraving, quality assurance, etc. In SNGPL, different corrosion prevention methods were demonstrated to the students that are essential in the gas pipeline. Students also shared their future plans with the management. Industry members discussed their recruitment criteria and what they expect from their potential candidates.

~PC: Syeda Imaan Fatima

NON-TECHNICAL ACTIVITIES

Mechatronics Club, a diverse culture and organization, also focuses on non-technical events. Such events promote soft skills in the students and serve as a recreation for the students.

ORIENTATION WEEK

Orientation Week is organized to welcome the junior students of the department warmly. This year's orientation week included multiple activities like Departmental Visit, Photo Booth, Orientation Ceremony, Test Your Brain Game, Scavenger Hunt, Battle of Reflexes, Stepping Stone Games, Colour Symposium, and Closing ceremony. Such activities help as an ice-breaker for the newcomers and form a bond of sincerity among the juniors and senior sessions.

SEMINARS

Mechatronics Club organizes seminars to give students a chance to learn about interesting and informative topics. This year's seminars included Industry 4.0 Automation, Entrepreneurial Journey, Entrepreneurship and Spirituality, and A Conversation about Conversations.

Enabling Entrepreneurship

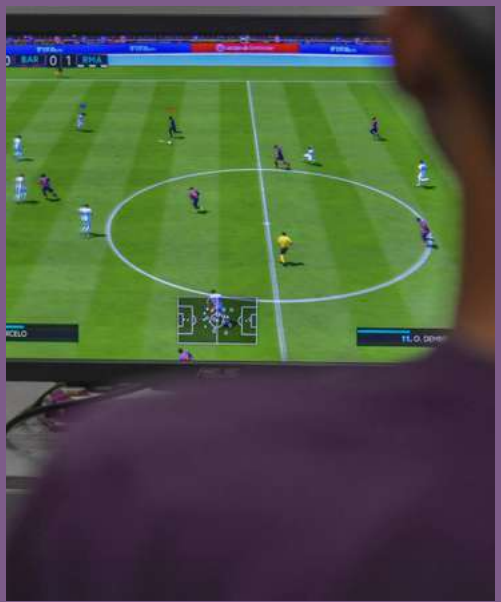
Organizational Behaviour and Leadership

A conversation about conversations

GAMOFIESTA

The Mechtronics Club presents "GAMOFIESTA." An electrifying and thrilling event promoting gamers to test their skills by participating in different games, including:

- Tekken
- PUBG Mobile
- VR Beat Saber
- Ludo and chess
- Marvel Quiz
- Wire Loop



RESCUE-1122 SESSION

Mechatronics Club arranged a session on rescue 1122 and invited the staff to demonstrate the following:

- Basic personal safety in case of natural disaster or fire eruption.
- Dispersion place in case of emergency.
- Immediate report on emergency numbers provided by the Government of Punjab.
- Basic first aid training.

MEDIA WORKSHOP

Non-technical events like Media Workshop are important for refreshment and grooming students regarding non-technical knowledge. They act as a break from the hectic routine of engineering studies and provide a platform to learn something practical and productive. For this Mechatronics Club collaborated with the AKS Photography Society. This media workshop had the following modules:

- Poster Making Workshop
- Photo Editing Workshop
- Video Editing Workshop

FLOOD RELIEF CAMP

Mechatronics Club played its role with UET and raised funds for medicines, clothing, tenting, and food for the people caught up in flood in the hour of trial.

OUTREACH PROGRAM

Numerous other collaborative events and workshops were also organized for the students' grooming, learning, and personality development.

Mechatronics Club initiated the outreach program to the different colleges and institutes. This outgoing outreach program communicates the significance of the emerging Engineering Field: Mechatronics and Control Engineering. The students are enlightened about this program's eminence and the future field's scope. The students are also introduced to our departmental society, 'Mechatronics Club,' helping our students groom their technical and soft skills. The seminars are being delivered along with showcasing the projects to invoke the student's interest and love for engineering.

The students of this age feel a gap in their career counselling and need more understanding of the present technological fashion. We believe that counselling by relevant and respected seniors and pupils can overcome this lack of guidance. The clarity of mindset would eventually lead to better career planning and future endeavour. Pakistan lacks the accomplishments in the scientific and technological contest being recognized internationally. The main reason is the absence of awareness of the future scope and advancement. This is not about the discussion of the scope of a field anymore. This is a time to produce potentially genius brains and exceptional innovators. So they can make their scope and break Pakistan's conventional and stereotypical career preferences. The mode of education has changed over the years, and the world is going for ideas and innovations. We believe the awareness will stimulate students' interest and help them devise their future goals. The future lies in advancing a nation toward automation and intelligent system. We do not want our juniors and youths to miss the opportunities we missed due to a lack of comprehension and roadmap. Thus, the outreach team is an excellent opportunity to help students understand the current technological and scientific atmosphere.

Until now, Mechatronics Club has done its outreach program at GCU Lahore (Government College University) and The Trust School.

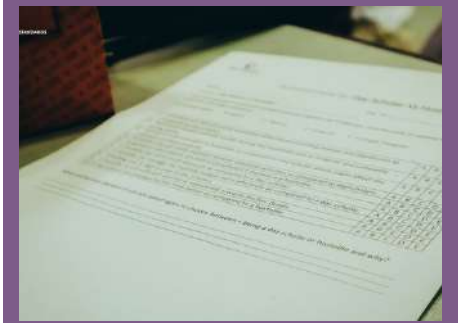
The Trust School

MECHATRONICS FORUM

(A platform to discuss various social issues affecting an Engineer's life)

Mechatronics Club has arranged important and informative sessions using the Mechatronics Forum platform to discuss different social issues that may impact an engineer's life. Basically, it will help students achieve effective objectives by developing constructive perspectives and motivating peers about the services an engineer can easily provide to the community using their skills.

Ma'am Quratulain Masud is the moderator and is leading this activity under the supervision of our respected Chairman, Dr Ali Raza. Students of the Mechatronics Department have to take one step forward, come on stage and talk about community service using their own stories. Discussions are based on reasons, examples and facts. There will be two teams from different sessions comprising 3 members.



Main Motives

Our main Motives are:

- Be kind and respectful of the views of others.
- Be constructive and facilitate meaningful discussion.
- No personal attack or any bigotry.

Recently, we have debated on the following topics:

❖ Community Service Series
❖ Day Scholars VS Hostilities.
❖ Online or On-campus teaching/assessment

Community Service Series

The "Community Service" topic was a series of three sessions. Community service in an engineer's life refers to activities that contribute to improving the quality of life in a community. It can also include activities like teaching computer programming to students, designing and building playgrounds, or providing free technical support to those in need.

Day Scholars VS Hostilities

This topic's primary outcome is that Day scholars often have the convenience and comfort of living at home. At the same time, hostilities enjoy the independence and social life of living in a dorm. Both sides have advantages and disadvantages, making this debate challenging to settle. Ultimately, whether to live at home or on campus is up to each student and should be based on their personal needs and preferences.

Online or On-campus teaching/assessment

The debate of "Online or On-campus Teaching/Assessment" is an essential topic in education. On one side, online teaching offers students the convenience of learning from anywhere, anytime and at their own pace. On the other hand, on-campus teaching provides a more traditional learning experience and the opportunity to interact with professors and classmates.

ALUMNI SUCCESS STORIES

Serving across Pakistan and abroad in several domains, Our Alumni are making a positive impact through their passions and skills.

MUHAMMED SAAD SOHAIL

Batch 2015-2019
Support Engineer
UltraTech International

As an experienced Mechatronics Engineer with 3.5 years of professional experience, I have successfully managed a variety of projects in the field of industrial automation systems. During my 2 years of employment at Qadri Engineering, I was responsible for planning, designing, and installing the SCADA system, safety instrumentation, auto power factor controllers, and implementing the 5S system in our department. I also played a key role in preparing preventive maintenance plans for off-season machine maintenance. Currently, I am a Support Engineer at UltraTech International, where I have been managing several projects involving installing and commissioning various industrial automation systems such as metal detectors, check weighers, pallet stabilization projects, and glueing machines. With my expertise in project management, installation, and commissioning of industrial automation systems, I have contributed significantly to the growth of the companies I have worked for.

HUMA AKBAR

Batch 2016-2020
Incharge and Founder
-KidsLogiX world and Robosmart Creative Club, Lahore

Right after my graduation, I evaluated my interest in the teaching profession, so I decided to involve kids and teenagers in technological and innovative education e.g., computational thinking, Robotics, and computer programming through the approach of STEM education from an early age. I believe in an inquiry-based learning methodology that offers a learner-centred community where learners work together to solve real-world problems. I believe that this way of learning empowers their will to explore problems and uncover solutions. And it helps them to improve their confidence and decision-making power. I worked with different institutions, e.g. Robokids, LGS 30 main Gulberg, and ALS DNK school system. Besides this, I am working on my startup entitled “Kids Logix World”, where I am providing online services to international-level students. Being a learning guide (Teacher) provides me with an opportunity for continual learning and growth. And I feel there is a need for compassionate, strong, and dedicated individuals who are motivated and excited about working with students and putting efforts to share knowledge in a way to bring change in society.

WAHAJ ARSHAD

Batch 2016-2020
Support Manager
UltraTech Internationall

Spending four years in this department has shaped me not only as an engineer but also as a person. I was part of a team that developed the first novel machine of its kind in Pakistan under the Ad sells Group for a cleaner, sustainable country. The project was successful and inaugurated by PepsiCo Pakistan in 2021 in Islamabad.

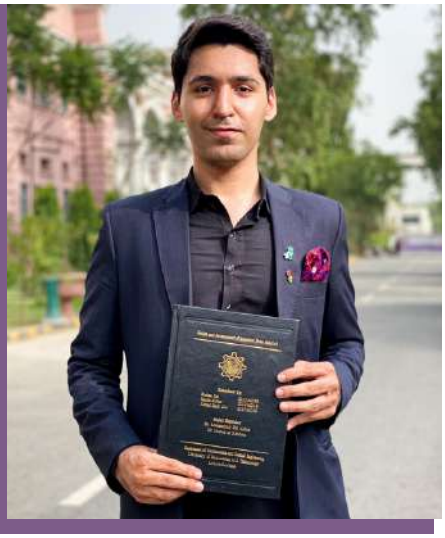
After the project caught some attention, Unilever Pakistan also showed interest in this initiative and partnered with Ad sells to deploy their own machines. The second major project that falls under my belt is the Digital Standee. A conventional replacement of the traditional advertising methods, this project was a major success for the company, increasing its business by a surplus amount, selling to big companies like Atlas Honda, Johnson's, Syngenta, and countless more. Apart from that, I have developed some new samples with my team for the digital wing of the company and have managed multiple projects since then. As of now, I am ready to embark on a new set of challenges and opportunities by starting my new position as Support Manager at UltraTech International.

HAMZA HASSAN

Batch 2016-2020
QHSE & Maintenance Engineer
-Dubai

I was proudly an active Mechatronics Club member, which helped me fit in with a global company. I am employed by a firm in Dubai that complies with all ISO (ISO 9001:2015 QMS, ISO 14001:2015 EMS, and ISO 45001:2018 OH&S) and UN standards as a QHSE & Maintenance Engineer. I've been the most active employee here during my time, and I've led the quality department through several adjustments and enhancements. In my company, I am the youngest employee, the youngest Quality Manager based on performance, and the youngest person to complete a "Quality Audit." I have several noteworthy accomplishments in my more than one year of employment, but one that stands out is, in the eight years of history, I am the first quality professional to negotiate and connect the system of my company with Dubai Civil Defense. I oversee the maintenance department in addition to the quality department and deal with automated electro-mechanical machines (PLCs).

AHMED ALVI



Batch 2017-2021
AI & ML developer
Devsinc

Growing up in a military family means frequent moves to different locations, adapting to new environments and cultures, and experiencing the unique challenges and benefits that come with being part of a military community. Whilst growing up in this environment instilled a deep sense of patriotism in me, it also enrooted a seed of being tech savvy and interested in AI, which later became my passion. Currently, I'm working as an AI & ML developer at Devsinc and also doing a remote job with a Canadian company which itself is an accomplishment for me at this level because I switched my field after doing a field job at Fatima Fertilizer for one year.

ANS MEHMOOD

Batch 2017-2021
Software Developer
-CureMD, Pakistan

I had been keenly interested in critical analysis, problem-solving, and logical reasoning. During my undergrad studies in Mechatronics Department, I worked on several projects that could help me find replacements in the IT industry.

Now, I am working as a Software Developer at CureMD Pakistan. Here I cleared Mathematical thinking, Critical thinking, and Creative Thinking courses for better growth. Also, I have been awarded as Problem-Solving Champion in CureMD Engineering Awards, 2023.

ABDUL MAJID

Batch 2018-2022
Associate Software Engineer
CureMD, Pakistan

In last semester, my fellows were getting hired at different Mechatronics related Jobs, and I was also looking for a good opportunity. I made it to the final Interview of many companies but was rejected at the last stage. During those days in June 2022, I came across an opportunity for Web Bootcamp by CureMD which was a Govt. funded program to promote IT jobs in the country due to high demand. I joined it, performed well during that Bootcamp, and got hired in the same company. I am working as Associate Software Engineer currently where my role includes developing different features in Web Applications. Switching the field was not easy at all but that's how your life works. One has to be adaptable in life and career. I learned a lesson that I would like to share with everyone reading this and i.e., Never bind yourself and keep trying on different opportunities you are hit with.

OMAR ASHRAF

Batch 2018-2022
Junior Data Scientist, ML1

Ever since my childhood in Jeddah, I have been interested in robotics, AI, and similar technological advancements. That was why I enrolled in the Mechatronics program, but it was due to our CP course and Sir Ahsan Naeem that I found my true passion for programming and AI. I am currently working in a leading AI company in Pakistan as a Junior Data Scientist. My job description includes R&D as well as the implementation of many advanced AI techniques. I have worked on an NLP product as well as a highly advanced generative AI product. Other than this, I have also had the honour of visiting UET on behalf of my company at the UET Career Fair '23 as a technical representative. My journey so far has been great and I am excited to see where life will take me next.

MAHEEN ABDUL GHANI

Batch 2018-2022
AI Trainee
crowdfunding startup

After completing my O-levels and A-levels, I joined UET. During my bachelor's, I've been active in extracurricular activities and also started my own NGO WinSci (Women In Science). Some of my accomplishments have been listed below:

- University Gold Medal in Engineering
- Global UGRAD 2021 Scholar (fully funded exchange scholarship in the USA)
- Dean's List Honors, exchange semester, Otterbein University, USA
- 100% UET Merit Scholarship for 6 semesters
- Grit Plus Award for Best Performance in CureMD Young Inventor Program 2021.
- Winner of the Global UGRAD Community Development Initiative Award, Amount: $ 400
- Best Case Study Project "Apps for Effective Reporting" (Senior Internship at Punjab Revenue Authority)

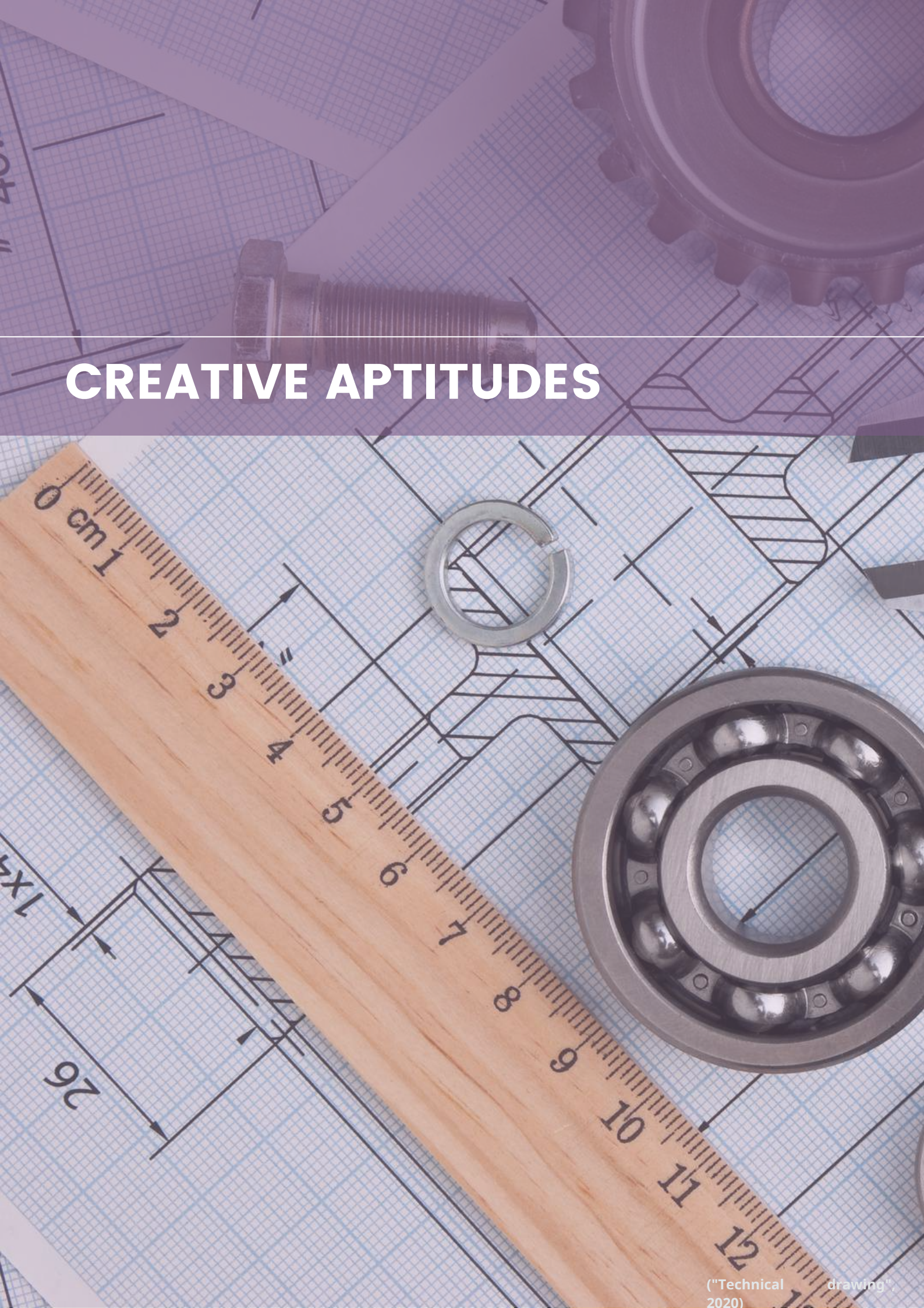
After graduation, I worked as an AI Trainee and then Technical Course Instructor at a US-based IT company. Currently, I'm working on a crowdfunding startup with a German team.

MUHAMMAD AHMAD

Batch 2018-2022
Senior Machine Learning Engineer
-Voiceflip, Canadian Startup

I have worked as a Machine Learning Engineer/AI developer with top-level companies worldwide. Currently, I am working with voice flip that is a Canadian startup, as a Senior Machine Learning Engineer. I am also doing my masters in Artificial Intelligence at NUST. Mechatronics Department at UET has helped me in understanding the potential of these technologies by offering courses in Deep Learning and Programming and paved my path to work with international-level organizations.

CREATIVE APTITUDES

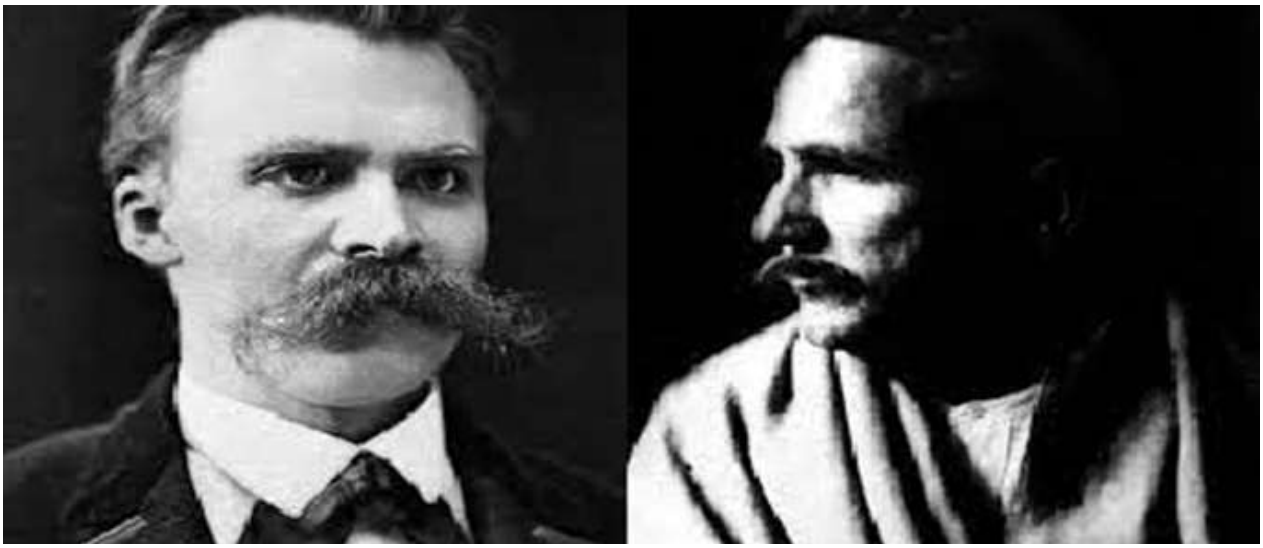


("Technical drawing", 2020)

COMPARATIVE LITERATURE & PHOTOGRAPHY

("quill pen and ink", 2019)

Divergent Paths, Common Themes: A Comparison of Iqbal and Nietzsche's Notions of the Ideal Self



"His heart is of a believer but mind disbeliever" [1], are the words Iqbal mentioned in his poetry about Nietzsche, which mark an intriguing internal conflict within individuals, a tension between the soul and the intellect. Both were prominent philosophers of the modern era and are widely known for emphasizing self-actualization and individual empowerment.

A concept of "Ubermensch", the super being, is presented in the writings of Nietzsche [2], an individual who struggles and ultimately rises above a conventionally established sense of morality and hence embraces a life of self-mastery, self-actualization, and creative expression with the virtues of independence and strength embedded in himself and the courage to shape one's values and destiny entrenched. The overman idea seems to be great, but it may end in disaster as the pursuit of individual will for greatness and rejection of the existence of common ethical obligations and social norms lead to egoism, moral relativism, and narcissism and hence disregarding the community. This will conclude in at least a fragmented and disconnected social fabric, with socio-political imbalance and injustice. The thought of self-absorbance may cause a hindrance in the way of genuine connections with humanity and cause self-isolation. But the most disastrous point, the central theme of Nietzsche's idea, is the quest for power and dominance, which will result in exploiting others for one's benefit if not checked by social and moral values. Mindful of all these potential pitfalls, a concept should be there to highlight self-empowerment but not at the expense of humanity.

Iqbal's concept, on the contrary, known as "Khudi", addresses all the manifolds of human life, both in individual and collective spheres. Being a holistic approach, the three steps of this path are submission, self-control, and divine vicegerency [3]. According to Iqbal, the best example of a perfect man is no one but Muhammad ﷺ. Submission, self-control, and a sense of being vicegerent to the divine are the factors that ask one to stop from worldly desires, ruthless ego, and lust for power. In his works, Iqbal has quoted several traditions about incidents of personalities of great reputation across the Muslim World and hence defined all the three stages of

"Khudi" [4] in a way that not only tends toward the creator but also toward His creations.

In this regard, Iqbal owes a good deal of conceptions and ideologies to the Sufi Philosophers [5] but not to the Westerns. In a letter, he wrote: "I wrote on the Sufi doctrine of the perfect man more than twenty years ago, long before I had read or heard anything of Nietzsche" [6]. Moreover, Iqbal criticized Nietzsche for his atheistic and Godless views, his negation of mortality and hereafter; he wrote, "If this Frankish Sage, were present in this age; him would Iqbal teach, God's high place and reach". [7] He considered such thoughts a source of hate, suspicion, and resentment.[8]

It can be concluded that although Nietzche's idea is a compelling vision of self-actualization, it has inherent societal risks. Iqbal's concept integrates a sense of self-actualization with a sense of duty toward God and fellow human beings, offering a mindful pathway toward collective success.

- M. Noor Sultan

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[2] Nietzsche, Friedrich. Thus Spoke Zarathustra: A Book for All and None. Translated by R. J. Hollingdale.
[3] Iqbal, Muhammad. The Secrets of the self (Asrar-i-Khudi). Translated by A. R. Nicholson.
[4] Iqbal, Muhammad. The Mysteries of Selflessness (Rumooz-i-Bekhudi). Translated by A. J. Arberry.
[5] Bilquees R Dar, Iqbal and Nietzsche: Perfect man versus Superman
[6] Letter dated 24 January 1921, to Nicholson. reproduced in S.A. Vahid. Ed., Thoughts and Reflections of Iqbal
[7] Iqbal, Muhammad. Gabriel's Wing (Bal-i-Jibril). Translated by Naeem Siddiqui.
[8] Iqbal, Muhammad. The Reconstruction of Religious Thought in Islam

PHOTOGRAPHY

SALMAN FAROOQ
2020-MC-44

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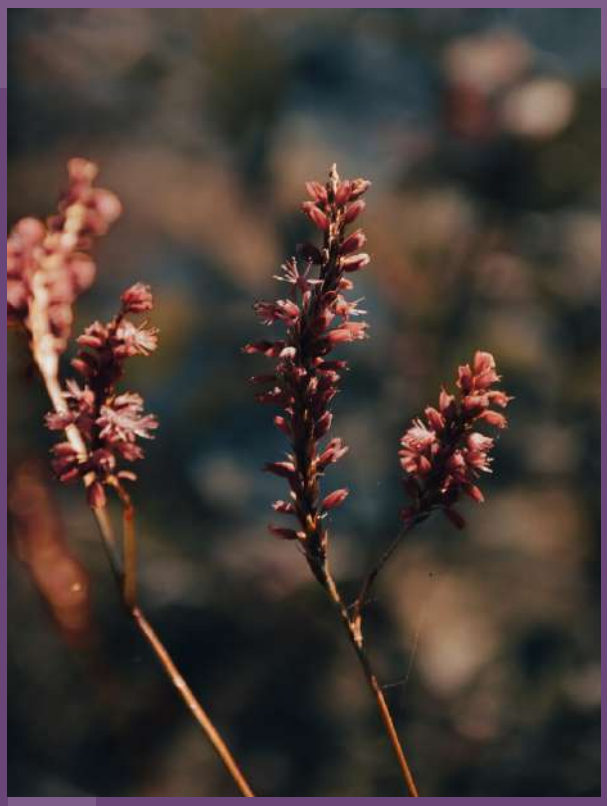

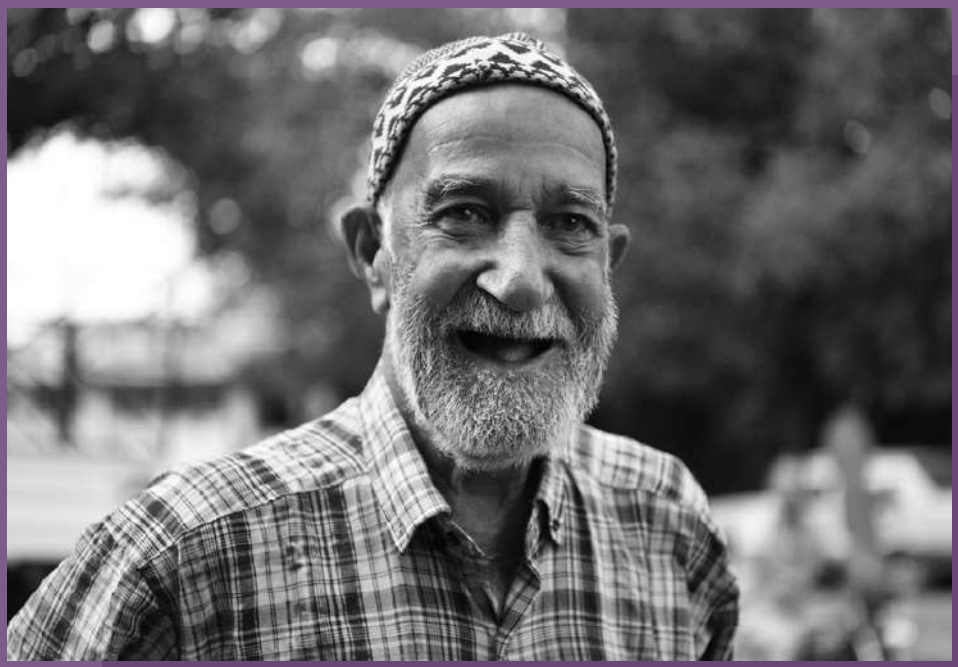

Muteeba Javed
2022 session

Ibrahim Haroon
2020 session

Munizah Qasim
2022 session

YEARBOOK QUOTES

Muhammad Amaan Majid
2019-MC-48

"Work hard now, so you won't have to say, 'I wish I had worked hard'."

Ume-Habiba
2019-MC-36

"Shoot for the moon. Even if you miss, you'll land among the Stars."

Talha Hassan
2019-MC-02

"Dare to be different, for it is through uniqueness that we leave our mark behind."

Syed Faraz Ali Rizvi
2019-MC-30

"The more you praise and celebrate your life, the more there is in life to celebrate."

Muhammad Talha
2019-MC-47

"The future belongs to those who believe in the beauty of their dreams."

Raja Haseeb Ahmad
2019-MC-69

"Results are rewarded more than efforts."

Dawood Imtiaz
2019-MC-27

"Choose your words wisely, for they have the power to ignite change, uplift hearts, and create a legacy."

Muhammad Qasim Saleem
2019-MC-26

"Embrace the power of knowledge, for it illuminates the path to a limitless future."

Usman Tariq
2019-MC-31

"Life is 10% what happens to us and 90% how we react to it."

Muhammad Ahmad
2019-MC-14

"Never be afraid, for what is written will come to be. Just give your best, live your life with joy, and create beautiful memories along the way."

Muhammad Umar Mubashir
2019-MC-20

"Excellence is not a skill, but a mindset."

Muhammad Ali Haider
2019-MC-01

"The caffeine overdoses were worth it."

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