DR.NGP INSTITUTE OF TECHNOLOGY

DEPARTMENT OF BIOMEDICAL ENGINEERING

MAGNETRON – A STUDENT MAGAZINE

JANUARY – JUNE 2017

BME/Magnetron/Vol.5 / Issue.1/ 2017

FACULTY CORNER

REALISTIC 3D IMMERSIVE VISUALIZATION OF UNBORN BABIES

Parents may soon be able to watch their unborn babies grow in realistic 3-D immersive visualizations, thanks to new technology that transforms MRI and ultrasound data into a 3-D virtual reality model of a fetus, according to research being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

MRI provides high-resolution fetal and placental imaging with excellent contrast. It is generally used in fetal evaluation when ultrasound cannot provide sufficiently high-quality images. Researchers in Brazil created virtual reality 3-D models based on fetal MRI results. Sequentially-mounted MRI slices are used to begin construction of the model. A segmentation process follows in which the physician selects the body parts to be reconstructed in 3-D. Once an accurate 3-D model is created -- including the womb, umbilical cord, placenta and fetus -the virtual reality device can be programmed to incorporate the model.

"The 3-D fetal models combined with virtual reality immersive technologies may improve our understanding of fetal anatomical characteristics and can be used for educational purposes and as a method for parents to visualize their unborn baby," said study co-author Heron Werner Jr., M.D., Ph.D., from the Clínica de Diagnóstico por Imagem, in Rio de Janeiro, Brazil. The virtual reality fetal 3-D models are remarkably similar to the postnatal appearance of the newborn baby. They recreate the entire internal structure of the fetus, including a detailed view of the respiratory tract, which can aid doctors in assessing abnormalities.

3-D foetal image

For the virtual reality device, Dr. Werner and colleagues used the latest-generation Oculus Rift 2 headset. Oculus Rift 2 places the user in an immersive environment, complete with heartbeat sounds derived from the ultrasound of the foetus. Users can study the 3-D foetal anatomy simply by moving their head."The experience with the Oculus Rift has been wonderful," Dr. Werner said. "It provides foetal images that are sharper and clearer than ultrasound and MR images viewed on a traditional display."

The technology has numerous potential applications, including assessment of foetal airway patency. Airway patency, or the state of airways being open and unblocked, is an important issue for a developing foetus. For example, if ultrasound showed an abnormal mass near the foetal airway, physicians could use the 3-D images and the headset to assess the entire length of the airway and make better informed decisions about delivery.The technology also can help coordinate care with multidisciplinary teams and provide better visual information to parents to help them understand malformations and treatment decisions.

Virtual camera

"The physicians can have access to an immersive experience on the clinical case that they are working on, having the whole internal structure of the foetus in 3-D in order to better visualize and share the morphological information," Dr. Werner said. "We believe that these images will help facilitate a multidisciplinary discussion about some pathologies in addition to bringing a new experience for parents when following the development of their unborn child."The researchers have used the technique on patients at a clinic in Rio de Janeiro, including cases where the fetus had evidence of an abnormality that required postnatal surgery. They hope to use the technology more broadly over the next year.

Ms.D HEMAPRIYA

AP/BME

FOUR IMPORTANT WAYS THAT BIOENGINEERING HAS ENHANCED HEALTH CARE

Bioengineering is a fascinating discipline, blending traditional engineering with issues of health care. As outlined by an article from the American Society of Mechanical Engineers, bioengineers work to help improve the lives of patients living with various conditions in a variety of ways, including through the design of new digital tools, software platforms, instruments and other devices. In essence, the practice of bioengineering refers to the design and creation of technologies that aid the health care process in some way. Innovation in this area of engineering will no doubt continue in accordance with the development of technology — improving health care and patient outcomes in the process.Bioengineering as a profession has a wide scope, with innovations in a number of areas. This article will explore some of the most important areas in which bioengineering have made a positive impact on the health care industry so far. They include:

1. Biomechanics

Biomechanics involves the study of the human body, how and why it moves, and how biological processes within the body respond to external pressures. Engineers in this field employ an array of principles to guide their study, including classical mechanics, physics and mathematics, with an emphasis on sport and athletics, an article by the Houston Chronicle explained. Indeed, this field has greatly enhanced health care because biomechanics conduct research that can be used to help athletes and others who are physically active. For example, biomechanical research tends to inform the development of sports-related products, such as training devices, footwear and so on. This research is crucial, not only to improve athletic performance, but also to reduce the risk of injury.

2. Biomechatronics

Research in this area involves the development of devices and platforms that can respond to and even be used within the human body, the Biomedical Engineering Society has detailed. The objective of biomechatronics is to build devices that can improve the lives of patients who have some form of disability or illness, wherein certain functions are weakened or lost entirely. The biomechatronics lab at the Massachusetts Institute of Technology, for example, is working on the frontlines to enhance the health care industry, through the development of technologies that enable those with limited or lost mobility to begin moving again. Although much of the work carried out by the lab remains in the design stages, examples of technologies that could improve the lives of many living with limited mobility include

Devices that allow neural control of prosthetics, implants that allow communication between prosthetic devices and the central nervous system and exoskeleton devices that can be used to improve running. Indeed, as the latter device demonstrates, research in this area has the capacity to not only help those living with disability, but also to enhance healthy physiological functions — improving running in athletics is a pertinent example.Perhaps one of the most notable feats of biomechatronics so far, again courtesy of the Massachusetts Institute of Technology, is the biomechatronicleg joints, invented by Hugh Herr, the European Patent Office reported. The device, nicknamed the **bionic knee**, essentially allows amputees to return to a normal lifestyle, by allowing them to walk in a fully functional way.

3. Biomedical electronics

Biomedical electronics is the branch of bioengineering dedicated to the development, design and maintenance of devices that are used in health care settings such as hospitals and clinics. Biomedical electronics, as a discipline, has enhanced the health care industry considerably, thanks to the development and introduction of devices that are widely relied upon today, such as intensive care unit monitoring systems, CT imaging systems, dialysis machines and surgical lasers. In fact, virtually every device designed to test or treat patients in a clinical setting falls under the remit of biomedical electronics. Professionals in this area of bioengineering will either work in a research capacity, working toward the development of new platforms, or in a maintenance capacity, helping repair biomedical electronic equipment and overseeing proper use.

4. Tissue engineering

A relatively fledgling practice, tissue engineering remains very much in the research stages, but it is widely agreed that the practice holds considerable promise in terms of the enhancement of future health care practices. As outlined by an article published by the National Institute of Biomedical Imaging and Bioengineering, tissue engineering is essentially the development of synthetic or natural human tissue in a laboratory — tissue that can then be utilized to help patients with an array of medical conditions, from severe burns to failing organs. Tissues that have been successfully engineered include cartilage, skin and even liver and muscle tissue. The article stressed, however, that it is still rare for engineered tissue to be used on human patients.Tissue engineering holds enormous promise for the future of health care, thanks to large demand for alternative therapies for chronic conditions such as organ failure, severe tissue damage and so on.

Ms. .SHARMILI S

AP/BME

DENGUE AND SEVERE DENGUE: HERE'S ALL YOU NEED TO KNOW

Dengue is a mosquito-borne viral disease that has rapidly spread in all regions of WHO in recent years. Dengue virus is transmitted by female mosquitoes mainly of the species *Aedes aegypti* and, to a lesser extent, *Ae. albopictus*. This mosquito also transmits chikun gunya, yellow fever and Zika infection. Dengue is widespread throughout the tropics, with local variations in risk influenced by rainfall, temperature and unplanned rapid urbanization.

Severe dengue (also known as Dengue Haemorrhagic Fever) was first recognized in the 1950s during dengue epidemics in the Philippines and Thailand. Today, severe dengue affects most Asian and Latin American countries and has become a leading cause of hospitalization and death among children and adults in these regions.There are 4 distinct, but closely related, serotypes of the virus that cause dengue (DEN-1, DEN-2, DEN-3 and DEN-4). Recovery from infection by one provides lifelong immunity against that particular serotype. However, cross-immunity to the other serotypes after recovery is only partial and temporary.

The incidence of dengue has grown dramatically around the world in recent decades. The actual numbers of dengue cases are underreported and many cases are misclassified. One recent estimate indicates 390 million dengue infections per year (95% credible interval 284–528 million), of which 96 million (67–136 million) manifest clinically (with any severity of disease). Another study, of the prevalence of dengue, estimates that 3.9 billion people, in 128 countries, are at risk of infection with dengue viruses. Before 1970, only 9 countries had experienced severe dengue epidemics. The disease is now endemic in more than 100 countries in the WHO regions of Africa, the Americas, the Eastern Mediterranean, South-East Asia and the Western Pacific. The America, South-East Asia and Western Pacific regions are the most seriously affected. Cases across the Americas, South-East Asia and Western Pacific exceeded 1.2 million in 2008 and over 3.2 million in 2015 (based on official data submitted by Member States). In 2015, 2.35 million cases of dengue were reported in the Americas alone, of which 10200 cases were diagnosed as severe dengue causing 1181 deaths. The year 2016 was characterized by large dengue outbreaks worldwide. The Region of the Americas region reported more than 2.38 million cases in 2016, where Brazil alone contributed slightly less than 1.5 million cases, approximately 3 times higher than in 2014. 1032 dengue deaths were also reported in the region. The Western Pacific Region reported more than 375000 suspected cases of dengue in 2016, of which the Philippines reported 176 411 and Malaysia 100028 cases, representing a similar burden to the previous year for both countries. The Solomon Islands declared an outbreak with more than 7000 suspected. In the African Region, Burkina Faso reported a localized outbreak of dengue with 1061 probable cases.

In 2017 (as of Epidemiological Week 11), the Region of Americas have reported 50172 cases of dengue fever, a reduction as compared with corresponding periods in previous years. The Western Pacific Region has reported dengue outbreaks in several Member States in the Pacific, as well as the circulation of DENV-1 and DENV-2 serotypes. An estimated 500 000 people with severe dengue require hospitalization each year, and about 2.5% of those affected die.

Distribution in India::

With 19,704 cases reported till September 6, the dengue cases in the country have already doubled. In 2014, the number of dengue cases stood at 10,097, with 37 deaths, through the year. In 2016, however, 41 people had died, though the Health Ministry said in a statement that with a fatality rate of 0.20 per cent, casualties remained "very low", when it was more than 3 per cent. With 1,259 cases reported so far, Delhi topped the list of cities with the most cases. However, Arunachal's East Siang district with 1,618 cases (the state has reported 1,681 cases) was the district with highest number of cases, followed by Chittoor in Andhra Pradesh with 761 cases, Thiruvananthapuram (602 cases) and Kasargod (443 cases) in Kerala, respectively.

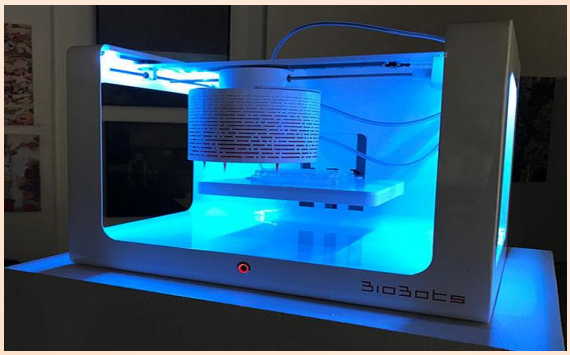
The Union Health Ministry, meanwhile, is in talks with the Indian Council of Medical Research for a possible notification to ban rapid diagnostic test kits for dengue on the ground that at a 50 per cent error rate, the false positives given by the rapid test, was only adding to the panic. "The rapid test gives a lot of false positive results, sometimes in up to 50 per cent of cases. We are discussing with ICMR whether we should issue a notification banning the kit. At present hospitals are required to notify only those dengue cases that have been tested either by Elisa or IgM," said Director General, Health Services, Dr Jagdish Prasad. Health Secretary J. Radhakrishnan said the State had seen a total of 1,752 dengue cases till October 18, 2016 accounting for 3.4 per cent of the total number of cases reported country-wide. "In the current year, instead of focused outbreaks, we have been seeing mixed infections including water-borne, vector-borne and zoonotic infections," he said, adding that the focus was not only on the prevention of dengue but also on other diseases such as leptospirosis, scrub typhus typhoid, malaria, Hepatitis A and diarrhoeal diseases ahead of the rainy seasonThe Health Minister also pointed out that there were no 'mystery fevers' and that the King Institute of Preventive Medicine had the capacity to identify 29 different types of viral fevers. The public has been advised to ensure that there is no stagnant water around their homes, close windows between 4 and 7 p.m., make children wear full-sleeves when they go out to play, opt for only qualified medical professionals when unwell, hydrate those with fever adequately with fluids including coconut water and kanji.

Ms. K.R. MOHANAPRIYA
AP/BME

STUDENT CORNER

NEW BIOPRINTER MAKES IT EASIER TO FABRICATE 3D FLESH AND BONE

The ideal 3D bioprinter, says tissue engineering expert Y. Shrike Zhang, would resemble a breadmaker: “You’d have a few buttons on top, and you’d press a button to choose heart tissue or liver tissue.” Then Zhang would walk away from the machine while it laid down complex layers of cells and other materials.The technology isn’t quite there yet. But the new BioBot 2 printer seems a step in that direction. The tabletop device includes a suite of new features designed to give users easy control over a powerful device, including automated calibration; six print heads to extrude six different bioinks; placement of materials with 1-micrometer precision on the x, y, and z axes; and a user-friendly software interface that manages the printing process from beginning to end.



A 3D Bioprinter

BioBots cofounder and CEO Danny Cabrera says the BioBot 2’s features are a result of collaboration with researchers who work in tissue engineering.**“To push this work forward, we had to do more than just develop a new robot.”,said by** Danny Cabrera, CEO of BioBots.

“We’ve been working closely with scientists over the past year and a half to understand what they need to push this work forward,” he says. “What we found is that they needed more than just a bioprinter—and we had to do more than just develop a new robot.”The company’s cloud-based software makes it easy for users to upload their printing parameters, which the system translates into protocols for the machine After the tissue is printed, the system can use embedded cameras and computer-vision software to run basic analyses. For example, it can count the number of living versus dead cells in a printed tissue, or measure the length of axons in printed neurons. “This platform lets them measure how different printing parameters, like pressure or cellular resolution, affect the biology of the tissue,” Cabrera says.

Ms HEMALATHA B

IV BME

CANCER NANOTHERAPY

Nanotechnology is fulfilling medical science's need for more precise treatments that are less invasive, less costly, and less complicated to administer than traditional methods. That translates into better patient outcomes, lower healthcare costs, and wider access to healthcare services in under-resourced parts of the world.Medical Nano devices and materials are already in widespread use. Inorganic nanoparticles of materials synthesized from metals such as gold or silver and ranging in size from 1 to 100 nm are commonly used as contrast agents in in vivo tumor imaging and as molecular probes for the study of cellular or subcellular function. Quantum dots fabricated from semiconductor materials are similarly valued as alternatives to fluorescent proteins, organic dyes, or radioisotopes.

Setup for Cancer Nanotherapy

But not all medical applications of nanoparticles are as passive as these imaging tools. In fact, emerging cancer treatment technologies employ nanomaterial in ways that are not merely hands-on, but downright aggressive. For example, researchers at Israel's Bar-Ilan University have developed what they call nanobots to target and deliver drugs to defective cells while leaving healthy ones unharmed. The 25-35 nm devices are made from single strands of DNA folded into a desired shape – for instance, a clamshell-shaped package that protects a drug while en route to the desired site but opens up to release it upon arrival. Led by Bar-Ilan professor Ido Bachelet, the team has so far developed DNA robots that can recognize 12 different cancer cell types, and is now working to program swarm behavior into bots designed to physically bond in the body for the other applications such as tissue or nerve repair.

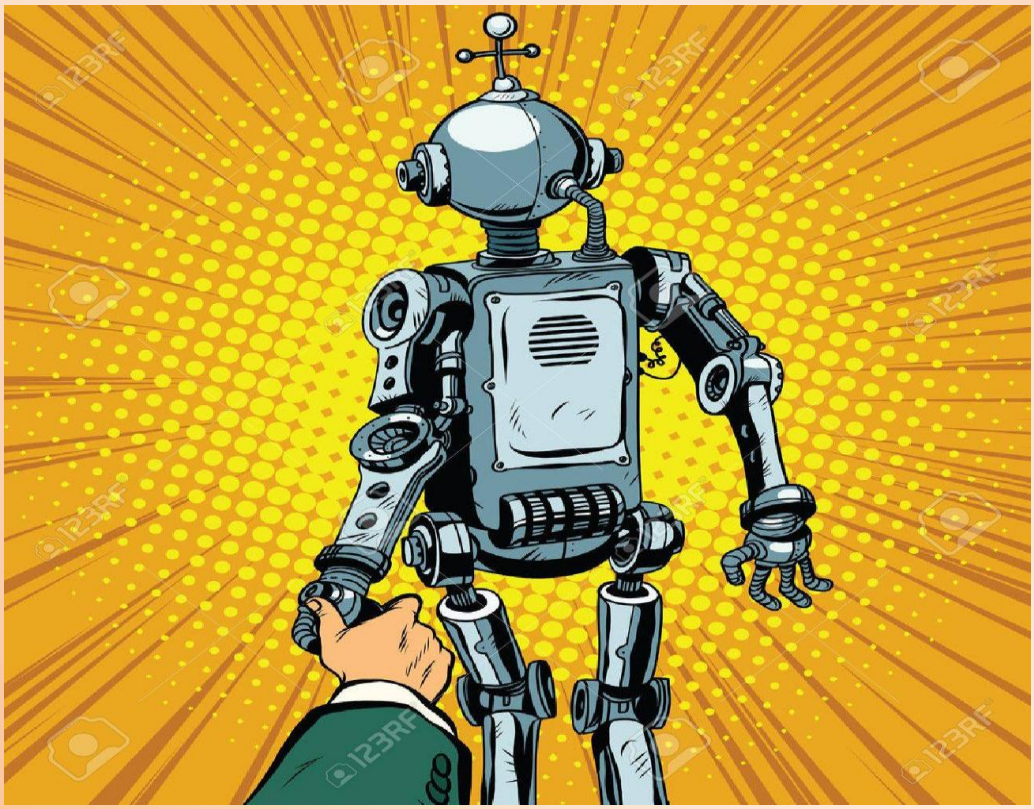
Mr. DINESH. .R

III BME

The role of nanotechnology in our lives today.

-Have we become too dependent today?

We are living in a society which is called “technologically civilized” society. Every small work we do is technology dependent. Today every other person is recognised with the device or gadget, he/she carries; which is technically advanced. Ultimately, we can say that,”living without technology is like living without oxygen” in this technical world of today. Therfore, we are much dependent on technology.



MOVING BEHIND TECHNOLOGY

Ms. HARISHMA S

II BME

NEW TAKE ON A CLASSIC TOOL

Smartphone stethoscope

The humble stethoscope is back and coming to a smartphone near you. This fixture of every kid's toy doctor kit has been outshone by today's arsenal of sophisticated electronic diagnostic tools. Doctors and nurses still pay attention to a patient's heart and lung function, of course, but now it is often easier and more definitive to order x-rays, electrocardiograms, or other, more advanced tests. But a new electronic take on this old-school tool, the Eko Core (Eko Devices, Berkeley, CA) attaches to an analog stethoscope to provide seamless analog and digital sound, which it transmits using Bluetooth to the cloud, from where a doctor can download it to a smartphone. Selected by Time magazine as one of the top inventions of 2015, the scope does the listening for the doctor, who can visualize waveforms in real time, record and playback body sounds, share recordings, and store data in the patient's electronic health record in compliance with federal patient privacy rules. The scope could help reduce healthcare costs related to unnecessary specialist care by helping general practitioners take more advanced measurements on their own.

Ms. BHUVANESHWARI .R
III BME

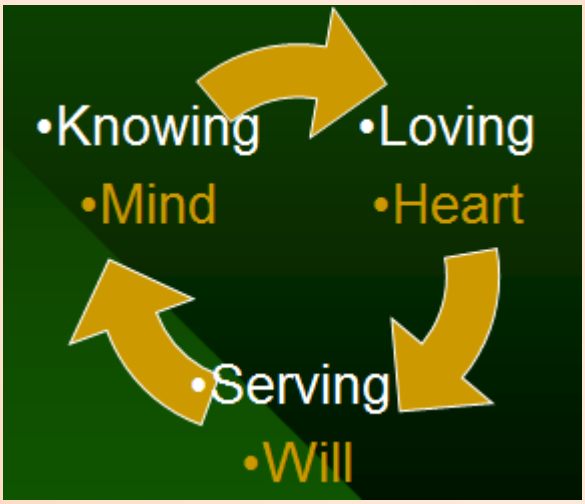
EDUCATION AND HUMAN VALUES

MANTRAS OF EUCATION:

1. Is a powerful social force.
2. Transmits and shapes culture and beliefs.
3. Can reveal and develop the potentialities inherent in each individual.
4. Can prepare individuals to contribute to the well-being of themselves, their families, their communities, and to humankind as a whole

MANTRAS OF HUMAN VALUES:

1. The building blocks of human personality.
2. The endowments of every human being and the adornments of the human spirit.
3. In conjunction with the development of skills and abilities, concepts and attitudes, empower us to transform both ourselves and society.



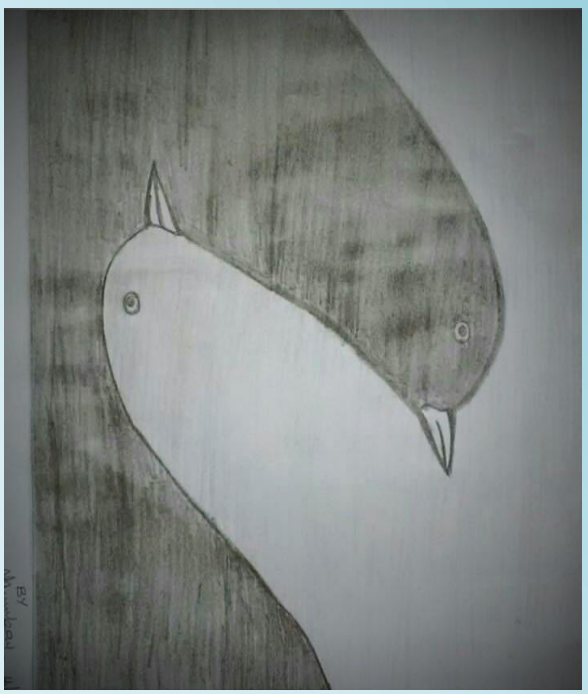
EDUCATION IN HUMAN VALUES

1. Requires an understanding of the essential oneness of humankind applied on a universal basis.
2. Constitutes an indispensable foundation for the universal respect for human rights.
3. Must be integrated into all aspects of formal and non-formal education.

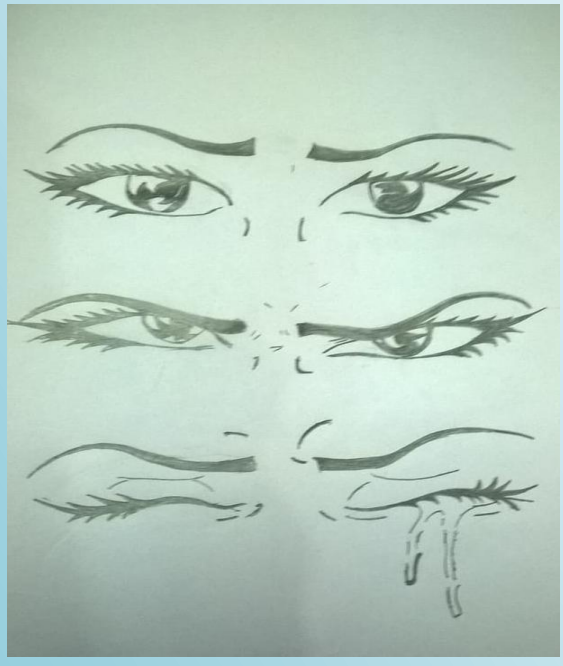
Mr.SELTON E

III BME

ART CORNER

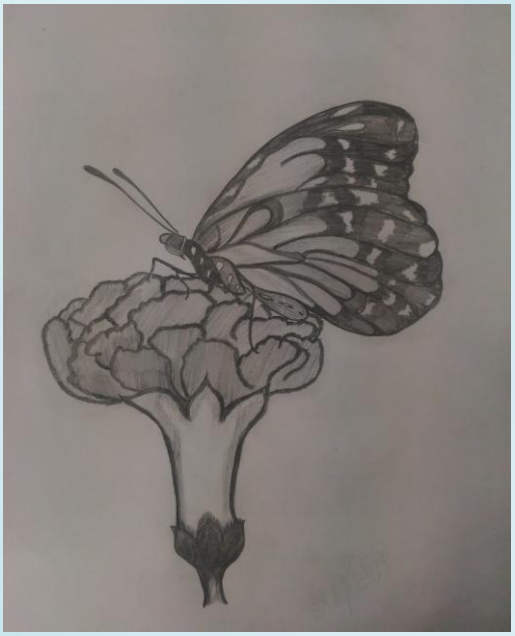


Ms. MUTHUBALA .M
III BME



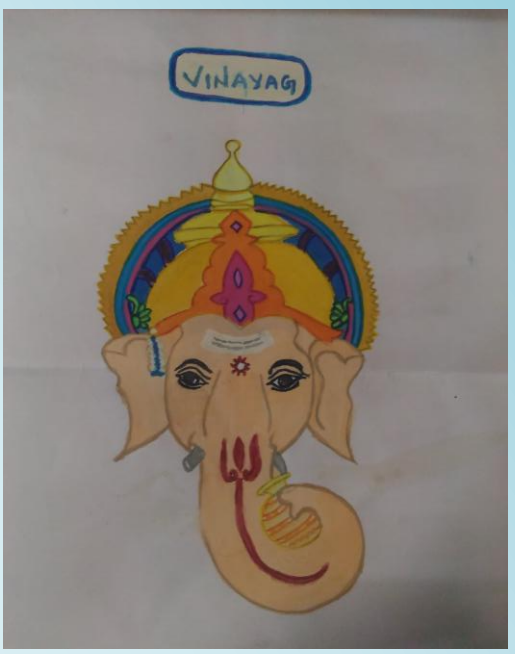
Ms. SARANYA S

III BME



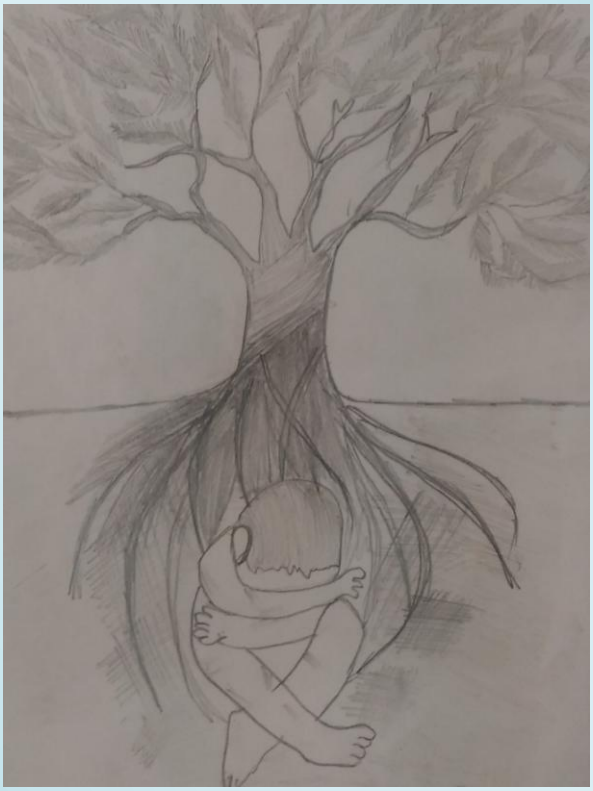
Ms. MATHUNITHA U S

II BME



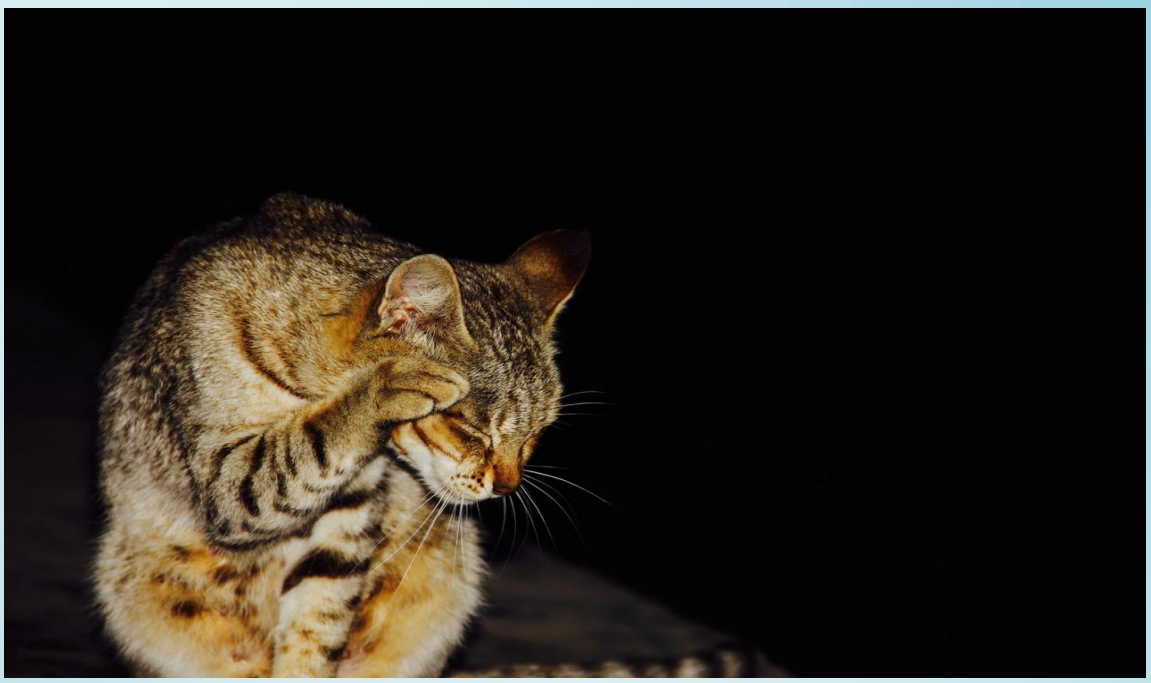
Ms. SARANYA B
II BME

Mr. SATHYA SOORAJ M
II BME



Ms. HARISHMA S
II BME

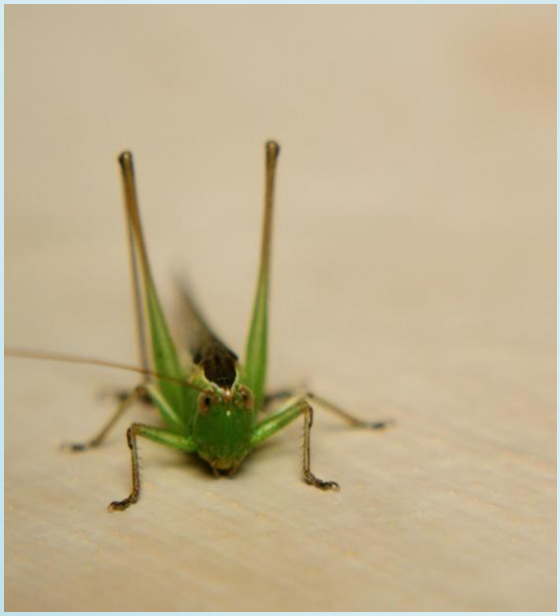
PHOTO CORNER

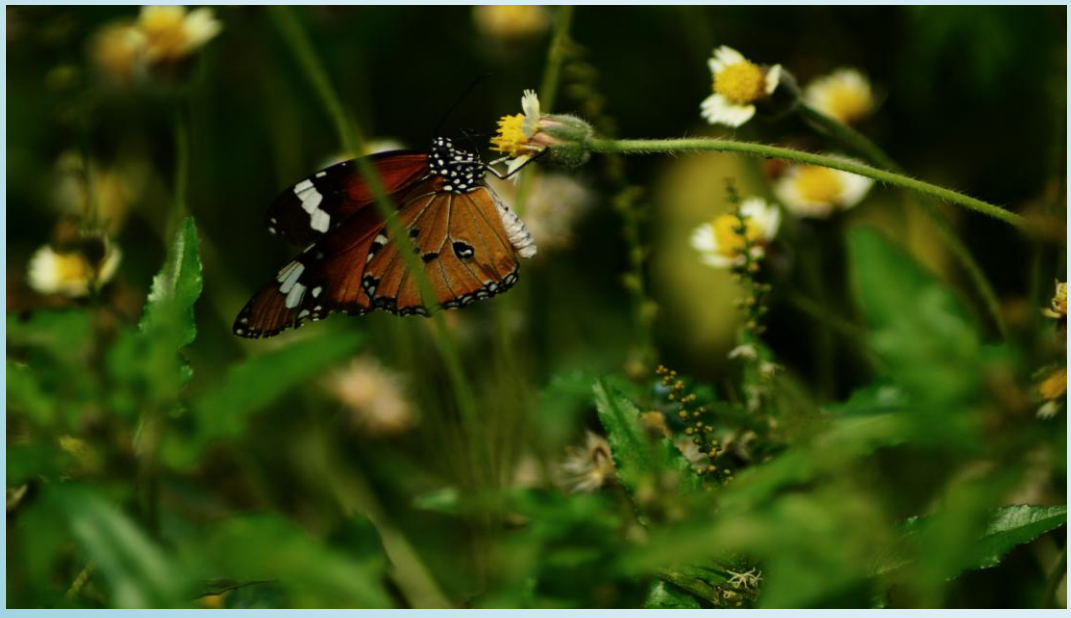


Mr. PRATHEEPAN N

III BME

Mr.RAMESH P
III BME





Mr. HARI SURYA A
II BME

VISION OF THE DEPARTMENT

To produce quality biomedical engineers with strong **technical knowledge** and excellence in **engineering design** for providing solutions to **healthcare problems**.

MISSION OF THE DEPARTMENT

The stated vision of the Department of Biomedical Engineering will be achieved by:

MD 1 : Integrating engineering and life sciences for the development of **innovative biomedical products**.

MD 2 : Imparting **quality education** through innovative Teaching - Learning methodologies.

MD 3 : Collaborating with **healthcare industries** for education, training, research and development.

MD 4 : Establishing **state-of-the-art facilities** to enhance the technical skills.

MD 5 : Providing sustainable solutions for challenges in **global healthcare** with ethical, social and moral values.

Program Educational Objectives (PEOs)

PEO 1 : Have **successful career** in Biomedical Engineering and other relevant disciplines.

PEO 2 : Design **devices, systems and processes**for improving healthcare industries.

PEO 3 : Engage in **lifelong learning activities** to become a member of globalized engineering teams with ethical values and standards.

KOVAI MEDICAL CENTER RESEARCH AND EDUCATIONAL TRUST
K.M.C.H CAMPUS, AVINASHI ROAD, COIMBATORE-641014
Ph. 0422 4323721, Fax. 0422 2627196
E-mail : info@kmch.ac.in www.kmch.ac.in