



Welcome to Session By Technical Education and Skilling on Empowering Bengal: Nurturing Future Ready Skills For A High Precision Work Force

**BENGAL GLOBAL
BUSINESS SUMMIT**

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Padma Shri (Professor) A.K. Ray, Former Director, IEST-Shibpur, Former Vice Chancellor-BESU, Shibpur, Founder Director-IIIT Kalyani and Former Director (Additional Charge) NIT Agartala.

Padma Shri Prof. Ajoy Kumar Ray, retired Professor of Electronics and Electrical Communication Engineering at IIT Kharagpur, joined Bengal Engineering and Science University, Shibpur as its Vice Chancellor with effect from 01.03.2009, on lien from IIT Kharagpur. Prior to this assignment, he was a Professor of Electronics and Electrical Communication Engineering and Head, School of Medical Science and Technology at IIT Kharagpur.

Prof. Ray has successfully completed more than 20 research projects and several consultancy projects, and he was the Principal Investigator of Research Projects, sponsored by Intel Corporation during 1997-2004 and Texas Instruments, UIA. He has been granted 12 USA patents at the School of Medical Science and Technology at IIT Kharagpur. Prof. Ray was associated with the University of Southampton as Senior Research Fellow during 1989-90 and led the research group on "Image and Video Processing" of Avisere Inc., USA during 2004-2005.

He has published more than 200 research papers in International journals and Conferences and has authored five books published by International Publishing Houses, such as John Wiley, McGraw Hill, Prentice Hall and Taylor and Francis Publication, including one in Chinese.

In addition, under his leadership his group in the School of Medical Science and Technology has completed research projects on Molecular Imaging and Image Processing, Medical Instrumentation, Early detection oral, breast and cervical cancer, Coronary Artery disease detection, Epidemiological Studies and Bioinformatics, all of which are of national importance. Prof. Ray is the Fellow and Member of many professional bodies and is involved with a large number of Universities in their academic bodies. He has been a member of a number of national committees on Higher Technical Education. He has been associated with the Nehru Museum of Science and Technology, IIT Kharagpur as Secretary and Chairman 1991-2006. He was conferred Padma Shri for his contribution in Science and Engineering in 2017. Currently, Prof. Ray is the Director of JIS Institute of Advanced Studies and Research, Kolkata, JIS Group where a number of funded research projects sponsored by DBT, DST, ICMR on Advanced 3-D Bioprinting, Biosensors, AI and ML driven Bioinformatics are being executed.



Prof. Ajoy Kumar Ray



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Precision Engineering in Bio-Medical



By Padma Shri Prof. Ajoy Kumar Ray

Point of Discussion

- Devices and Implants in Biomedical Engineering
- Material Science and Engineering in Biomedical Applications
- 3D Printing in Biomedical Engineering
- Bio Printing in Biomedical Engineering

Devices and Implants in Biomedical Engineering

Overview: Biomedical engineering develops devices and tools that aid in the diagnosis, treatment, and rehabilitation of patients.

Key Devices:

- Medical Implants: Pacemakers, orthopedic implants, stents.
- Diagnostic Devices: MRI, CT scanners, ultrasound machines.
- Therapeutic Devices: Insulin pumps, dialysis machines.
- Prosthetics: Artificial limbs, bionic arms.

Impact: These devices enhance patient outcomes and quality of life by improving functionality and precision in medical treatments.

Material Science and Engineering in Biomedical Applications

Overview: Material science focuses on developing biocompatible materials used in biomedical devices and implants.

Key Materials:

- Metals: Titanium, stainless steel (used in orthopedic implants).
- Polymers: Biodegradable materials for sutures, drug delivery systems.
- Ceramics: Used in joint replacements and dental implants.
- Biomaterials: Hydrogels and bioactive materials that promote healing.

Challenges: Ensuring materials do not induce rejection or harm, while providing durability and functionality in the human body.

3D Printing in Biomedical Engineering

Overview: 3D printing, or additive manufacturing, enables the creation of complex, custom medical devices and structures.

Applications:

- Custom Implants & Prosthetics: 3D printed custom prosthetics tailored to individual patients' needs.
- Anatomical Models: 3D printed models for pre-surgical planning and practice.
- Orthotics: Personalized supports for joints or limbs.

Benefits:

- Cost-effective production.
- Reduced lead time for creating complex designs.
- Enhanced precision for personalized medical devices.

Bio Printing in Biomedical Engineering

Overview: Bio printing is an advanced form of 3D printing that uses bioinks containing living cells to create tissue and organ-like structures.

Applications:

- Tissue Engineering: Creation of skin, bone, and cartilage tissues for transplantation.
- Organ Printing: Aiming towards the creation of functional organs (heart, liver, etc.) for regenerative medicine.
- Drug Testing: Printing tissues for pharmaceutical companies to test drugs before clinical trials.

Challenges: Ethical concerns, scalability, and the need for vascularization (blood supply) in printed tissues.

Conclusion and Future Directions

Future Outlook:

- Enhanced integration of AI with biomedical engineering for smarter devices and personalized treatments.
- Continued advancements in bio printing to revolutionize organ transplantation and regenerative medicine.
- Greater focus on sustainable and ethical materials for implants and devices.

Conclusion: Biomedical engineering continues to evolve, offering tremendous potential to improve healthcare through innovative technologies and materials.