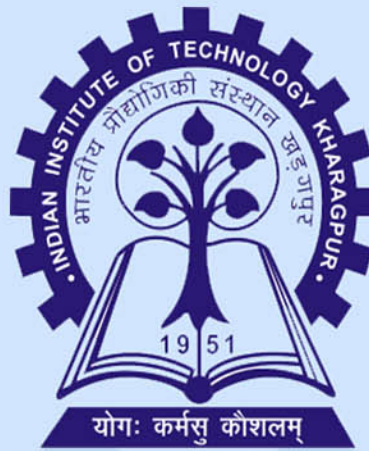


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Master in Medical Science & Technology
Indian Institute of Technology Kharagpur



The School of Medical Science & Technology

The spectacular advancements in the realm of medical science and technology that our globe has witnessed in the recent decades have been largely possible because of a marriage between medicine & technology. Our mission is to provide a platform of interdisciplinary teaching and research in the field of medical science and technology, which can lead to a better integrated healthcare delivery system in India. To meet the challenges posed by medicine in the 21st century, the country needs a new breed of medical professionals who can work towards the fusion of medical science with technology and can bridge the two disciplines.

Our vision is to have a medical academic institute with a *multi-specialty research centre* at its core, with the motto of education and collaboration for biomedical research and development, alongside treatment and healthcare delivery.

School of Medical Science and Technology (SMST), Indian Institute of Technology Kharagpur offers a 3 years post graduate program - Masters in Medical Science and Technology (MMST) for MBBS graduates. This programme imparts Science and engineering skills to medical professionals and train them for the state-of-the-art medical research in frontier areas of Medical Imaging, Molecular Imaging and Image Analysis, Biomaterials and Implants, Biophysics, Regenerative Medicine, Stem Cells, Medical Statistics, Telemedicine, Biomedical Instrumentation, Early Detection of Cancer, Immuno-technology, Reproductive Biology, Recombinant DNA Technology, Biomedical Simulation, Wound research Preventive & Promotive Healthcare system and so on. After the completion of this course the medical professionals become well equipped to fill the void that separates the medical sciences from advanced technology.

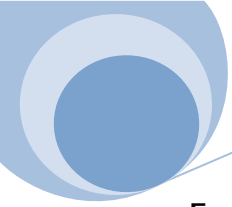
Apart from the existing 3 years interdisciplinary Masters Program in Medical Science and Technology (MMST) for medical doctors and MS and PhD programs in Medical Science and Technology, the school has introduced an M.Tech program in Medical Imaging and Informatics (2 years) from 2007.

Infrastructure at SMST

The students have access to some of the finest infrastructure available in the country for interdisciplinary research and development activities, some of which are:

Medical Imaging & Image Processing Lab

- Skin OCT
- Ultrasound scanner & 3D & 4D (with Colour Doppler)
- Fluorescence and Stereo Zoom Microscope
- Atomic Force Microscope
- Digital CR
- Picture Archival & Communication System (PACS)
- Optical Microscopes
- Live cell imaging facility



Embedded Systems Lab for Medicine

- Micro Controller
- DSP trainer Kit
- FPGA based Medical Chip design facility

Medical Instrumentation Lab

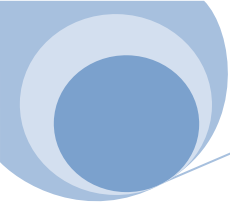
- PC based Spirometer
- Phono Cardiogram
- Pulse oximeter and blood gas analyzer
- Electro-Acoustic Transducers
- Fetal monitor
- State of the art electrode-tissue interface: MCS- Micro current stimulators and multi-channel recorders (Ripple Inc.)
- Assistive Devices for Neurorehabilitation
- G.Hlamp: 64 channel bio-signal amplifier for invasive and non-invasive measurements of brain functions (CE Approved)

Bio-material, Tissue Engineering & Translational Wound Research Lab

- Universal testing Machine
- FTIR
- UV Spectrometer
- Surface Profilometer
- Viscometer
- Ultrasonic Bath
- Furnace
- Contact Angle Measurement
- Extruder
- Isostatic Press
- Internal Mixture
- Electro Spinning Setup
- Freeze Dryer
- Diamond Saw
- CO2 Incubator
- Centrifuge
- Microtome
- Inverted Microscope
- Autoclave
- Deep Freezer (-80°C)
- Polisher for Metallographic

Cell and Molecular Biology facilities

- DNA finger printing
- Electroporator
- Hybridizer
- Horizontal gel electrophoresis systems
- Gel documentation set-up
- Southern blotting apparatus

- 
- PCR machine
 - Fluorescence and inverted microscopes
 - UV cross linker
 - Dark/cold room/radio-isotope facilities

Bioinformatics and Proteomics facilities

- Silicon graphics workstation
- Various softwares for protein analysis (RASMOL; RASWIN)
- HPLC
- Sonicator
- Western blotting apparatus
- ELISA reader
- Scintillation counter
- Vertical gel electrophoresis systems
- Lyophilizer
- Sequencing gel apparatus

Telemedicine

- Server and terminals
- Video conferencing unit
- Telemedicine software supporting live medical teleconsultation related to cardiology/radiology/pathology/oncology/ tropical diseases over ISDN and lease lines and integration with various medical instruments for diagnosis and treatment

Shared Facilities at Central Research Facility (CRF)

- MALDI-ToF Mass Spectrometry
- Automated DNA Sequencer
- Real Time PCR Machine
- 2D Gel Electrophoresis
- Fluorescence Activated Cell sorter
- Scanning Electron Microscope & TEM

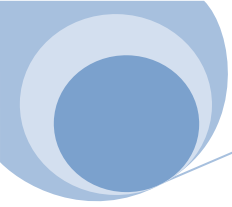
Some other Lab facilities of the School are:

- Clinical Skill Lab
- Medical Statistics & Informatics lab
- Herbal & Eco-friendly Medical Research Lab

Collaborations

The school and IIT Kharagpur has collaborations with many institutions and centers of excellence throughout the globe. Some of these are:

- Duke University Medical Centre, USA
- Brain Science Institute, RIKEN, Japan
- National University of Singapore, Singapore



- All India Institute of Medical Sciences, New Delhi
- Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow
- IPGMER, Calcutta
- Sree Chitra Tirunal Institute of Medical Science & Tech., Trivandrum
- CDAC, INDIA
- Texas Instruments
- RCC, Trivandrum
- VECC, Kolkata
- DST, DBT, DIT, Govt, of India
- GNDSIR, Kolkata
- NIOH-Kolkata, RIO-Kolkata
- Philips Research Lab., India
- GE Healthcare, Bangalore
- Tata Medical Centre, Kolkata

Faculty Members

- Prof. S. Chakraborty, PhD - Head
- Prof. S.K Guha, M.Tech, Ph.D, M.B.B.S. (Professor on reemployment)
- Dr. Koel Chaudhury, PhD
- Dr. Mahitosh Mandal, PhD
- Dr. Sangeeta Das Bhattacharya, MD (Paediatrics)
- Dr. Manjunatha M, PhD
- Dr. Jyotirmoy Chatterjee, PhD
- Dr. Soumen Das, PhD
- Dr. Santanu Dhara, PhD
- Dr. Analava Mitra, MBBS, PhD
- Dr. Chandan Chakraborty, PhD
- Dr. Nishant Chakravorty, M.B.B.S., MMST, Ph.D.

Associated Experts

- Dr. Parthasarathi Bhattacharya, MD DNB (Gen. Medicine) DM (Pulmonary Medicine)
- Dr. Pinak Pani Bhattacharya MD (Radio diagnosis), DM
- Dr. Provas Banerjee MS, PhD
- Dr. R.R. Paul, MD (Dental Surgeon)
- Dr. Soumen Roy, MD

Visiting Professor

- Dr. A.K. Bardhan, MD (Card.)

Consultant Radiologist

- Dr. Anup Sadhu, MD (Radial)



Focus Areas, Opportunities & Assistantship

Our Focus Areas:

- Medical Imaging & Image Analysis
- Telemedicine & Tele Surgery
- Reproductive Health
- Healthcare Information Management System
- Preventive & Promotive Health Care System
- Bio-markers and their application in Oncology
- Tissue Engineering
- Bio-Materials
- Bio-MEMS & Sensors
- Wound Healing Research
- Herbal Medicine
- Medical Instrumentation, Rehabilitation Engineering
- Regenerative Medicine
- Stem Cells

Opportunities:

- After the completion of this course, the medical professionals become well equipped to fill the void that separates medical sciences from advanced technology. With the two fields merging rapidly there is a need for people who are qualified in both the disciplines and well versed with the upcoming thrust areas for research.
- The students with MMST degree are the ideal candidates to provide the necessary technical inputs to various hospitals, medical industries and research institutes who are working on innovative techniques in medicine.
- The students can become extremely competent to take up challenging Techno-medical management tasks.
- They can also be effectively employed for identification of thrust areas of research and help an organisation in deciding which kind of research would be relevant and would reap benefits.
- Moreover they will be able to work on finer technical details of an innovative idea which the organisation may be contemplating to work upon
- The innovative concept of an intensive project spanning duration of one year in the final year provides an opportunity to investigate on a specific problem in a particular area of medical science and technology.
- The students are successfully employed in organisation like GE Healthcare, Philips Medical Systems, DRDO, Siemens etc, renowned hospitals.
- Many of them opt to go abroad and pursue further research in their domains of interest and bring laurels back to the country.

Assistantship:

Assistantship of Rs. 25,000/- per month is awarded to all the eligible students of MMST who maintain good academic performance, and render clinical services in B.C. Roy Technology Hospital, IIT Kharagpur for 10 hours per week.



Course Curriculum

Semester I (Autumn)

- Quantitative Techniques in Medicine
- Medical Biotechnology
- Physics for Medicine and Biology
- Programming & Data Structures
- Elective-I
- Animal Cell Culture & Immuno- Tech. Lab
- Programming & Data Structures lab
- CAD & Visualization

Semester II (Spring)

- Medical Imaging
- Translational Health Research
- Biomaterials
- Medical Electronics
- Elective-II
- Medical Electronics Lab
- Biomaterials Lab
- Seminar-I

Semester III (Autumn)

- Fundamentals of Medical Instruments
- Electives- III - V
- Medical Instrumentation Lab
- Minor Project - I
- Seminar-II

Semester IV (Spring)

- Healthcare Management
- Molecular Imaging
- Electives-VI - VIII
- Minor Project-II

Semester V (Autumn)

- Project I
- Comprehensive Viva-Voce

Semester VI (Spring)

- Project II

Electives Group

Elective - I (Any One)

- Evidence Based Medicine-I
- Immobilisation Technology
- Biometallurgy
- Plant Nutrition

Elective - II (Any one)

- Evidence Based Medicine-II
- Medical Technology, Society & Ethics
- Engineering Mechanics
- Biomechanics
- Internet & Web based Technologies
- r-DNA Technology

Elective III (Any one)

- Infertility and Assisted Reproductive Technology
- Simulation of Biomedical Systems
- Object Oriented System
- Algorithms for Bioinformatics
- Biophysics
- Technology Forecasting and Assessment

Elective IV (Any one)

- MEMS and Biosensors
- Cancer Biology
- Digital Image Processing and Applications
- Advanced Database Systems
- Communication systems and networking
- Digital Signal Processing
- Fuzzy Sets & Applications

Elective V (Any one)

- Telemedicine
- Advanced Biomaterials
- Data Warehousing and Data Mining
- Physics and Instrumentation of Medical Imaging

Elective VI, VII, VIII (Any Three)

- Pathological Image Processing
- Epidemiological Analysis
- Medical Instrumentation
- Pattern Recognition and Machine Intelligence in Medicine
- Biomedical System Engineering and Automation
- File Organization & Database System
- Computer Vision
- Nuclear imaging
- Computational Molecular Biology
- Environmental Setting of Socio-Technical Systems
- Management of Technology
- Stem Cell Biology and Therapy



Eligibility and Mode of Selection

The eligibility criterion for admission to MMST students is MBBS Degree recognised by Medical Council of India (MCI) with a minimum of 55% marks in aggregate and having passed mathematics at +2 level (even as additional subject) or from any recognized Open University. Seats are reserved for SC/ST/OBC(Non creamy layer) candidates and persons with disability (PwD) as per Govt. of India rules.

MMST students - The selection of is strictly based on the performance of the candidates in an objective type of written test of 2 hours duration. The candidate needs to answer 120 questions out of which 75 questions are assigned to the MBBS syllabi. The remaining questions are equally distributed to cover the syllabi of +2 level Physics, Chemistry and Mathematics. Each correct answer carries one mark and each wrong answer carries negative 0.25 marks.

Syllabus for MMST: 2016

Physics

Newton's Law of Motion, translation and rotation, energy and power, conservation of linear momentum, simple harmonic motion, Hook's law, First law of thermodynamics, expansion of solid, Gas laws, Maxwell distribution of velocity, waves, interference of two waves, total internal reflection, Coulomb's law, Ohm's law, Magnetic field due to current, Faraday's law of induction, Photoelectric effect, Bohr model of atom, Radioactivity.

Chemistry

Chemical equilibrium, chemical and enzyme kinetics, Nuclear chemistry, Enzyme catalysis, Coordination Chemistry - preliminary concepts, Bonding, Strong and weak interactions, Inductive and resonance effect on acidity and basicity, Characteristics reactions of alcohols, aldehydes, ketones, amines, carboxylic acids and their derivatives, Optical isomerism of compounds containing two asymmetric centers, Aromatic and heterocyclic compounds (one hetero atom), Carbohydrates, Amino acids, Nucleic acids and proteins: general structure and physical properties.

Mathematics

Algebra of complex numbers, Theory of quadratic equations and quadratic expressions, relationship between roots and coefficients, Arithmetic, geometric and harmonic progression, Equation of a straight line in various forms, angle between two lines, distance of a point from a line, lines through point of intersection of two lines, Limit, continuity and derivatives of a function, limit, and derivative of sum, difference, product and quotient of two functions and composite functions, Integration as the inverse process of differentiation, integration by parts.



Medical Sciences

Anatomy - gross and applied Physiology, Biochemistry and genetics, Pharmacology: emphasis on clinical pharmacology, Pathology including microbiology and parasitology - emphasis on microscopic structures. Social and preventive medicine : emphasis on infectious and communicable diseases, immunization and family planning, Medicine including Paediatrics, Surgery including Orthopaedics and Urology, Obstetrics & gynaecology, Ophthalmology and ENT, Anaesthesia and oncology, radio-diagnosis.

Test Cities for MMST 2016:

Bangalore, Kharagpur, Kolkata, Mumbai, New Delhi.

All candidates have to select 2 cities for MMST 2016 examination. However, depending upon availability of seats and number of applicants, a candidate may be allotted any city out of the 5 cities.

As limited seats are available in Bangalore and Mumbai, for these cities, the allotment will be done based

Application Procedure

MMST 2016 application is to be submitted only by an ONLINE process (internet based) by accessing the website <http://gate.iitkgp.ac.in/mmst> from 29th March 2016 till 22nd April 2016. Please follow the **step-wise Instructions** to fill in Online Application Form.

The application process is completely ONLINE. The candidates have to upload all necessary documents online. Hardcopy of the applications and certificates are not required to be sent.

Application Fees

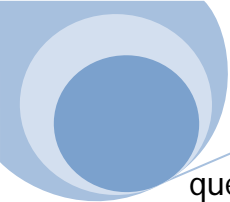
Rs.1500/- for General/OBC Male/Transgender candidates and Rs.750/- for all Female or SC/ST/PwD candidates.

Admit Card

Admit Card is issued only to eligible candidates who submit the application form completed in all respects before the closing date. In case if any candidate unable to download the Admit Card, they may contact the help desk.

Admission Test

The admission test is of objective type and is designed to identify the aptitude of the candidates for a program like MMST. The test is of two hours duration and held between 10:00 a.m. to 12:00 Noon on **Saturday, 28th May 2016** at Bangalore, Mumbai, New Delhi, Kolkata and Kharagpur. Candidate needs to answer 120



questions out of which 75 questions are assigned to the typical MBBS syllabi. The remaining questions are equally distributed to cover the syllabi of +2 level Physics, Chemistry & Mathematics. Each correct answer carries one mark and each **wrong** answer carries 0.25 negative mark.

Important Dates

Commencement of Online Application Form submission	29 th March 2016 (Tuesday)
Website closure for submission of Online Application Form	22 nd April 2016 (Friday)
Admit Card uploading on the website	To be announced later
Date of Examination	28 th May 2016 (Saturday)
Announcement of Results	To be announced later
Releasing 1 st list of candidates to whom admission will be offered	To be announced later
Last date for accepting the 1 st list offer	To be announced later
Releasing final list of candidates to whom admission will be offered	To be announced later
Last date for accepting the Final List offer	To be announced later
Registration Date	14 th July 2016 (Thursday)



Help Desk

All correspondence connected to Application processing and application status:

GATE/JAM Office
Indian Institute of Technology Kharagpur
Kharagpur - 721302, West Bengal
Phone No. (03222) 282091
Fax No. (03222) 278243
E-mail: gate@adm.iitkgp.ernet.in

All correspondence connected to MMST test and counselling:

Prof. S. Chakraborty
Head, SMST
Indian Institute of Technology Kharagpur
Kharagpur - 721302, West Bengal
Phone No. (03222) 282221
Fax No. (03222) 255303, 282221
E-mail: officesmst@smst.iitkgp.ernet.in

Disclaimer

Notice

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