

DIRECTOR'S REPORT

Chief Guest, Shri Montek Singh Ahluwalia ; Chairman, Board of Governors, IITM, Dr. A. E. Muthunayagam ; Members of the Board of Governors; Members of the Senate ; Graduands ; Distinguished Invitees ; and dear Colleagues and Students :

The Indian Institute of Technology Madras (IITM), was established in 1959 by the Government of India, as an institute of national importance. Its primary objective was to promote higher technical education, research and consultancy. The activities of the Institute in various fields of Science and Technology are now being carried out by 15 Departments and 5 Research Centres. The Institute Campus covers an area of 256 hectares of forest land and houses a community of about 11000 people.

The Institute offers several course-based undergraduate (UG) and post-graduate (PG) programmes as well as research-based post-graduate and doctoral programmes. It has, over the years, responded to environmental changes and user needs by redesigning curricula, offering new UG and PG programmes and specially designed user-oriented (UoP) M.Tech. and continuing education programmes. Our Preparatory Course Programme for Weaker Section Students offers intensive coaching to eligible candidates to prepare them for entry into IITM on successful completion of this one-year Programme. 35 (19 SC & 16 ST) candidates have been admitted to this Course in 2005.

The Institute also undertakes a large number of research and consultancy projects sponsored by a wide spectrum of funding agencies, including Government and Industry. IITM has active linkages with leading academic and research organizations in India, Australia, Germany, Japan, Malaysia, Singapore, UK and USA. This brief Report provides a summary of our activities, achievements and accomplishments in the different spheres of our activity during the year 2004–05.

1. THE FORTY-SECOND CONVOCATION

At this Convocation, a total of 1134 degrees are being awarded: 82 Ph.D., 98 M.S., 411 M.Tech., 37 M.B.A., 83 M.Sc., 80 Dual Degree and 343 B.Tech. These degrees cover a wide range of disciplines and specializations offered by the ten Engineering departments, three Science departments, the department of Management Studies

and the department of Humanities and Social Sciences. Among the Graduands are : 43 QIP candidates (teachers from other colleges), 32 sponsored candidates and 51 UOP candidates, 123 ladies, comprising 13 Ph.D., 14 M.S., 44 M.Tech., 23 M.Sc., 11 MBA, 2 Dual Degree and 16 B.Tech. students.

2. COURSE-BASED PROGRAMMES

IITM offers UG, Dual Degree and PG programmes in Aerospace, Chemical, Biotechnology, Civil, Computer Science, Electrical, Mechanical, Metallurgical & Materials and Ocean Engineering Departments and PG programmes in Applied Mechanics, Biotechnology, Chemistry, Humanities & Social Sciences, Management Studies, Mathematics and Physics Departments. User Oriented M.Tech. programmes are offered in Biotechnology, Civil, Computer Science, Electrical, Mechanical & Ocean Engineering departments.

Keeping in view that the role of designers in engineering industry is very important for its growth, a new dual degree program, with a B.Tech. in Engineering Design and a M.Tech. in Automobile engineering, has been started in IIT Madras. The Indian auto industry has promised full cooperation for making this program a success. It is a unique blend of engineering and aesthetics in design, with a liberal spread of practical laboratory classes. The students need to spend six months in the industry as a part of the curriculum. The following new facilities are being created for this programme: A graphic art studio, a virtual reality lab, a product design lab, ergonomics lab, mechatronics lab, vehicle dynamics lab, a new IC engine lab and Controls lab are being set up. The total cost is about Rs. 15 crores and a new building of about 60,000 sq.ft will also be constructed. It is expected that these facilities will be of use to other engineering departments as well.

3. ACADEMIC RESEARCH

IIT Madras continues to be very active in research and during the year under review, 82 Ph.D theses and 98 Master's theses have been completed. Our faculty and research scholars have published 589 research papers in refereed International (450) and National (139) Journals and have presented 881 research papers in International (543) and National (338) Conferences. At the risk of over simplification, I will attempt to give a flavour of the results obtained.

3.1 Ph.D Work

Aerospace Engineering

Prabhu Ramachandran, Ramakrishna & Rajan have established that it is possible to perform high resolution simulation and 2D incompressible flows, using the Lagrangian, grid-free, Random Vortex method.

Applied Mechanics

Jacob Thomas, Patil & Radhakrishnan obtained foot pressure images of diabetic subjects from Pedopower-graph and analysed them for planter ulcers. They used a 3D FE model to analyse varying foot sole properties for stresses and their effect on causing ulcers and designed a therapeutic footwear which has been clinically tested.

Sathiyarayanan, Sivakumar & Lakshmana Rao characterized the nonlinear nature of the electromechanical response of PVDF material.

Satya Devi, Sivakumar & Bhattacharya have gained insight into the importance of instability strain in the very low cycle fatigue behavior of some metallic specimens through experiments and proposed a simple life prediction methodology.

Biotechnology

Baskar & Anju Chadha developed an efficient biocatalytic method to synthesise alpha-hydroxy esters on a variety of substrates in the lab scale.

Santosh Kumar Padhi & Anju Chadha developed whole cell mediated deracemisation of beta hydroxy esters resulting in high optical purity product esters and elucidated the mechanism of deracemisation.

Akila & Chandra achieved low temperature biogas generation nearing 75% of mesophilic by using an adapted methanogenic consortia and isolated novel cold-adapted Clostridia and Methanogens which secrete cold tolerant xylanases and hydrolases of industrial interest.

Vijayalakshmi & Chandra demonstrated lipid accumulation and lipase activity prior to riboflavin production for the first time in *Eremothecium ashbyii* and genetic transcriptional regulation of riboflavin biosynthesis in *Ashbya gossypii*.

Chemical Engineering

Arvind Kumar Sharma, Chidambaram & Krishnaiah carried out experimental investigation on batch adsorption, fluidized bed hydrodynamics and fluidized bed adsorption for removal of dyes from waste water using activated carbon.

Maharudrayya Swamy, Sreenivas Jayanti & Abhijit Deshpande have developed design correlations to calculate pressure drop and flow distribution in different flow configurations used in PEM fuel cells and a comprehensive water balance model to predict the onset of flooding/dehydration.

Chemistry

Sudhakar & Sundararajan synthesized a new series of homogeneous catalysts in monomeric and tetrameric forms for ethylene polymerisation studies.

Satya Kishore & Varadaraju reported the synthesis and electrochemical studies on oxides and phosphides expected to be useful as electrode materials for rechargeable Li batteries.

Lakshminarasimhan & Varadaraju reported the study of Eu luminescence as a structural probe and for generation of white light for solid state lighting applications.

Shanmugam & Varadarajan synthesized organic-inorganic nanocomposites consisting of Keggin polyoxometalate films and showed that they exhibit photochromic and electrochromic behaviour. Several patents have been filed as part of this work. Antimicrobial activity of Ag and Au embedded composite film against E-coli BL 21 was also investigated.

Jothiramalingam & Varadarajan developed eco-friendly catalytic materials such as cerium incorporated manganese oxide OMS-2 for the catalytic wet oxidation of toxic phenolic compounds into non-hazardous chemical species like carbon dioxide and water.

Prabhakaran & Subramanian have developed ion-selective, sensitive, rapid and robust grafted polymers for the recovery of toxic and valuable metal ions from natural water samples and a new rapid and selective, diamide-modified reversed phase HPLC method for the separation and determination of uranium, thorium and lanthanides.

Prabhakara Rao & Vidyasagar have synthesized new metal organophosphonates at relatively low temperatures by hydrothermal and evaporation techniques. Some of these compounds are microporous, solid Brönsted acids and undergo topotactic intercalation reactions with ammonia and primary amines.

Civil Engineering

Ayothiraman & Boominathan carried out extensive experimental and numerical investigations on the lateral dynamic / seismic behaviour of piles embedded in clays and determined the depth of maximum dynamic bending moment.

Computer Science

Suryakanth Gangashetty, Yegnanarayana & Chandrasekhar developed a system for recognition of CV units in speech using support vector machines incorporating neural network models to compress feature vectors and detect voice onset points in continuous speech.

Palanivel & Yegnanarayana presented new methods for face tracking, facial feature extraction, visual speech feature extraction and face recognition using neural network models, for developing an online person authentication system.

Satya Sai Prakash & Raghavan proposed a generic architecture for a search engine and a design methodology based on two new concepts “Recency” and “Relevance” as a tool to assimilate and disseminate information from the web.

Rajesh Hegde & Hema Murthy employed a novel idea to carryout a systematic and thorough evaluation of phase-based features for speech recognition.

Electrical Engineering

Priya & Sridharan presented the first hardware-directed solutions and FPGA realizations for complete and reduced visibility graphs. They also presented hardware solutions for finding the point to point shortest path in a planar environment amidst polygonal obstacles using these visibility graphs.

Chitra Babu & Janakiram proposed a new programming language called DyaNaCola that provides constructs for expressing changing object behaviours in a program at run-time.

Klutto Milleth, Devendra Jaliha & Giridhar proposed two schemes for partial feedback based wireless communications applicable to base-stations employing multiple transmit antennas, one based on a single bit feedback and the other on a novel phase feedback technique.

Rangaraj, Devendra Jaliha & Giridhar exploited the available delay diversity in multipath fading channels to analytically evaluate the extent of decorrelation on the measurements, even when the spatial antenna elements are fully correlated and designed a space-frequency linear dispersive coding scheme to yield enhanced error rate performance.

Management Studies

Preeti & Thenmozhi showed that selected manufacturing companies in India raise finance through non-traditional debt instruments when profitability is low, thereby signalling prosperity of growth, confirming the information asymmetry and trade-off theories and the pecking order hypotheses.

Sudhir Ryan Daniel & Rajendran developed genetic algorithms and simulated-annealing algorithms to determine order-up-to levels in a serial supply chain with the objective of minimizing the sum of inventory carrying costs and shortage (or lost-sales) costs.

Mathematics

Shine Lal & Thamban Nair investigated new mollifier-type methods for obtaining stable approximate solutions for ill-posed problems in a general operator theoretic setting.

Shalu & Choudum studied several super classes of perfect graphs that have their origin in the works of Shannon and Berge on communication channels.

Anilkumar & Satyajit Roy investigated in detail self-similar, semi-similar and non-similar solutions of unsteady mixed convection flows over a rotating sphere, a rotating cone and a moving slender cylinder, respectively.

Vasundhra & Ponnusamy studied the geometric properties of certain families of analytic functions using certain integral transformations and obtained improved polynomial series expansions for Gaussian and confluent hypergeometric functions.

Mechanical Engineering

Muthukumar, Maiya & Srinivasa Murthy studied the performance of metal hydride based hydrogen compressor and storage devices taking into account the heat and mass transfer characteristics of the hydriding reactor.

Senthil Kumar & Venkatarathnam developed a highly efficient low cost single stage cryogenic mixed refrigerant cycle Joule – Thomson refrigerator.

Somashekar Hiremath, Singaperumal & Krishnakumar developed a methodology to study the dynamics of the fluid structure interaction of a jet pipe electro hydraulic servo valve with built-in mechanical feedback using Finite Element method. An experimental setup was also designed to determine the characteristics of some of the critical components.

Deivanathan & Vijayaraghavan studied the thermal aspects of grinding especially the significance of peak temperature and rate of heating on burn as well as the material dependant responses and established length of contact and metal removal rate as critical parameters in the control of burn.

Shajan Kuriakose & Shunmugam determined optimal conditions for achieving good surface finish and machining speed in wire-cut electro discharge machining of an aerospace material Ti6Al4V.

Mohan & Shunmugam investigated methods to simulate machining of single- and double- enveloping worm and worm gears, and the CAD application of such

simulations and showed that the machined geometry can be compared with design geometry and necessary corrections can be carried out to improve geometrical accuracy.

Wilson Samuel Jesudasan, Arunn Narasimhan & Venkateshan determined experimentally the effect of the inflow velocity profile on the porous media parameters such as the permeability and the form coefficient and deduced the importance of “wall channeling” effect in the pressure drop and heat transfer characteristics of rod bundles.

Krishnan, Balaji & Venkateshan measured the temperature distribution along the walls in vertical parallel plate channels, determined the convective and radiative heat transfer rates and showed that radiation heat transfer could reduce the maximum temperature by as much as 40%.

Premachandran, Balaji & Venkateshan developed a 2D code to numerically study multi-mode heat transfer in vertical channels with straight / converging / diverging walls as well as horizontal flow in a channel with discrete protruding heat sources and correlated the results using “asymptotic CFD” analysis.

Rajesh & Ramesh Babu investigated the effectiveness of high velocity water jets for peening of aluminium alloys by analyzing the magnitude of stresses induced on the surface with X-ray diffraction technique and proposed a new approach using liquid impact theory and Reichardt’s theory to predict the residual stresses induced on the surface treated with water jets.

Ajmal Deen Ali, Koshy Varghese & Ramesh Babu developed problem specific genetic algorithms for automated collision free path planning of two manipulators, each with 4 degrees of freedom i.e. 2 x 4 cooperative manipulators.

Metallurgical & Materials Engineering

Kamath & Prasanna Kumar developed a new algorithm for inverse heat conduction and applied it to define space and time varying heat extraction rates from a solidifying casting.

Suresh Babu, Pratap Haridoss & Vijayan synthesized and characterized CdS and PbS semiconductor quantum dots in a variety of matrices.

Palaniappa & Seshadri carried out electroless synthesis and surface property evaluation of Ni-W-P and Ni-W-B ternary alloy deposits, demonstrating their superior hardness and wear behaviour compared to their binary counterparts.

Balla Vamsi Krishna, Venugopal & Prasada Rao have successfully produced transition and bimetallic joints of dissimilar sintered powder metallurgical preforms - steel to copper and steel to aluminium - by the cold extrusion technique as energy effective and environmentally friendly replacements for fully dense joints.

Koteswara Rao, Kamaraj & Prasada Rao showed that the addition of scandium increases the joint strength of components made of Al-6%Cu significantly and that pulsed-current mode of gas tungsten arc welding increases not only strength but also ductility over the continuous current mode.

Srinivasa Rao & Prasada Rao found that the corrosion resistance of aluminum alloys is relatively better in natural aged condition than in the artificially aged condition and developed a method to remove copper-rich precipitates from the surface of aluminum alloys to improve their corrosion resistance. The corrosion resistance of fusion zone and partially melted zone of aluminum alloy welds was improved by pulsed current gas tungsten arc welding method.

Janakiram & Prasada Rao applied electron beam and laser beam welding processes to improve mechanical properties of the weld fusion zone in superalloy Inconel 718 and showed that pulsed arc mode of gas tungsten welding results in superior mechanical properties than continuous current.

Ramanaiah, Guha & Prasada Rao showed that application of grain refiners especially scandium not only improves the mechanical properties of fusion zone but also arrests cracking in partially melted zone in aluminum-magnesium-silicon alloys.

Ocean Engineering

Muthukkumaran, Sundaravadivelu & Gandhi carried out experimental, field and numerical studies on piles in sloping ground and described the effect of lateral soil movement due to surcharge load and dredging on the behaviour of the pile.

Vijayalakshmi, Sundaravadivelu & Murali developed formulae for prediction of forces and water elevation for a perforated circular caisson encircling a vertical cylinder based on the experimental and numerical studies and recommended a porosity in the range of 10-15% for the perforated cylinder.

Pavan Kumar & Ganesh Babu developed composites using a mixture of glass, polymer and steel fibres of excellent quality in terms of the strength and durability and impact and fracture characteristics.

Darga Kumar, Narasimha Rao & Sundar analysed the safe limits of cyclic load levels in terms of lateral deflections and earth pressures for seawalls constructed using caissons to prevent coastal zones from erosion and other effects of waves and currents.

Muni Reddy, Natarajan & Sannasiraj proposed design formulae for the estimation of water surface elevation in the pool, shoreward force and run-up on the sea wall defenced by off-shore rubble mound breakwater.

Gomathinayagam & Vendhan developed methods for evaluating wind force coefficients using field measurements on instrumented structures in natural wind with high turbulence.

Physics

Ramesh Chandra Mallik & Damodar Das carried out the thermo-electric characterisation of thin films of the binary semiconducting alloy system of Bi-Sb in the composition range 4 to 20 atomic percentage of Sb to highlight the effect of point defect clusters in decreasing the thermoelectric energy conversion efficiency of these materials.

Anantha & Hariharan synthesized and characterized a variety of Na⁺ ion conducting NaNO₃ based composite, polymeric and glassy solid electrolytes for potential application in solid state ionic devices.

Mani & Ramaprabhu carried out studies on the fundamental aspects of hydrogen absorption in AB₂ and AB₅ systems and on design and development of hydrogen storage devices.

Shaijumon & Ramaprabhu synthesised large quantities of high quality multiwalled nanotubes using metal hydrides as catalysts and developed CNT based PEM fuel cell and supercapacitor.

Lakshmi, Prasada Rao & Sunil Kumar developed a lattice gas model to investigate the existence of simple scaling in phase separating isotropic and anisotropic fluid mixtures and used a Monte Carlo algorithm to show that closed fluid membranes (Vesicles) subjected to active fission and fusion exhibit convoluted steady state shapes.

Ranjith, Balakrishnan & Sunil Kumar developed an accurate and fast method to compute the probability distribution of end to end vectors of a heterogeneous semiflexible polymer and used it to model the experimentally obtained cyclization data of short DNA filaments and to study the dynamics of single semiflexible polymers under the action of external forces.

Radha Ramani Vedantam, Murthy & Subramanian determined dielectric properties of certain lead based complex niobate perovskite oxides in single step, two step and three step methods to avoid formation of secondary phases and characterized them by structural dielectric and Raman studies.

3.2 M.S. Work

Aerospace Engineering

Ramana Kumar & Subramanian established the overall deformed shapes of plates by applying energy conservation based digital Intensity Integration Technique to reflected light from uni-directional optically divisioned finite strips of plate surfaces.

Karthikeyan & Velmurugan carried out the characterisation of polyester/clay and Polyester/glass fiber/clay (hybrid) composites and showed that the presence of clay improved all the mechanical, damping and thermal properties.

Jithesh Gopal, Ramakrishna & Rajan used data collapse in surrogate modelling of complex engineering problems and for pattern recognition in engineering data base.

Applied Mechanics

Dhanamjaya & Palaninathan presented a finite element method for hyperthermal heating and a boundary movement scheme for surface recession of carbon/ carbon composites used in nose tips and leading edges of re-entry space and hypersonic vehicles.

Gangadharan & Sivakumar have developed a combined r-h adaptive strategy in the form of relocation of nodes leading to a reduction in the errors in a finite element analysis.

Biotechnology

Swami Prasad & Venkatesh Balasubramanian developed an objective assessment of lower back pain in bar benders and developed a biomechanical model to evaluate the forces on the lower back. The results were validated by electromyogram based studies in field conditions.

Chemical Engineering

Sudarkodi & Kannan characterized the sonochemical reactor performance through rigorous non-linear bubble dynamics modeling of the cavitation field.

Snehalatha Cheethirala & Panda studied a biodegradable and biocompatible polymer produced under statistically optimized conditions from alcaligenes and developed a novel purification strategy.

Gokul, Pushpavanam & Abhijit Deshpande carried out modeling and experimental characterization studies of the velocity field due to bubble plumes.

Civil Engineering

Ramana Chandaka & Boominathan experimentally investigated the seismic behaviour of pile walls in sandy soil layer using sophisticated laminar shake table

test setup. It was found that the rigid pile walls reduce liquefaction induced lateral spreading of soil by about 40 - 50 %.

Sudhir & Boominathan carried out shake table studies to determine the effectiveness of cement column treatment in improving liquefaction resistance of loose saturated sand and found that even 1% cement content can drastically reduce the pore water pressure build up and settlement of the loose sandy ground during earthquakes.

Venkata Reddy Gali, Mohan & Boominathan developed fuzzy-neural network models based on cyclic stress and Arias Intensity approaches for the evaluation of liquefaction hazard during earthquake.

Sangeeta Kumari & Mohan developed four models to estimate recharge in an unconfined aquifer system taking into account the different soil parameters, rainfall, land use and infiltration rate. The models could estimate the recharge with a maximum error of 10% when tested in a watershed of Cuddalore basin in Tamilnadu.

Magesh & Mohan studied the effect of temperature on BOD decay rate and its implications on waste load allocation in rivers and developed a new model to predict measured water quality data in a river system.

Shanmugam & Mohan found that a two stage CSTR with hydrolyser and mechanizer performs better than the single stage system for anaerobic bioprocesses to treat the sago and tannery effluents mainly because the acidified pH maintained through phase separation eliminates $\text{NH}_3\text{-N}$ formation.

Vijayalakshmi Rayapati & Gandhi evaluated the smear zone created around a vertical drain by laboratory experiments and produced charts to consider the effect of smear zone in design.

Magesh Nagarajan & Krishnaswamy developed a new theoretical model to predict satisfactorily the bearing capacity of circular footings on reinforced soil beds with anchors.

Pandia Raj & Kalyanaraman developed a genetic algorithm based software for the optimum design of truss type of railway bridges.

Computer Science & Engineering

Guruprasad & Yegnanarayana have explored new features based on difference cepstral coefficients using pitch synchronous analysis of speech to enable speaker verification.

Devu Srikrishna Satish & Chandra Shekar have constructed hidden Markov models in the feature space of Mercer kernels for classification of varying length patterns of similar classes.

Srivathsan & Janakiram have proposed concurrency control algorithms for transaction processing in web based enterprise applications using a novel data centric approach to achieve steady performance from the web server in the presence of bursty traffic.

Muthukumar & Janakiram have developed a scalable generational garbage collector for Java programming language running on multiprocessor systems with extremely low pause times compared to the state of the art algorithms.

Rajesh & Janakiram have made attempts to provide mechanisms for refactoring low quality object oriented programs into high quality pattern based object oriented programs using Declarative Meta programming techniques.

Vaka Jayaprakash & Kamala Krithivasan have studied the computational capacity of a variant of P systems (which is the model of membrane computing), viz, "Tissue P systems" under rewriting and leftmost rewriting.

Kiran Kumar Penta, Sreenivasa Kumar & Deepak Khemani looked at the problem of monitoring physical devices by constructing a case base from streaming operational data.

Prasanna, Sreenivasa Kumar & Deepak Khemani addressed the problem of maintaining a continuously growing case base by removing cases that are too similar to other cases using a genetic algorithm approach.

Shyam Sundar Yadav & Deepak Khemani looked at knowledge acquisition from a relatively sparse data set using an ensemble of classifiers as an oracle to

label an augmented data set, before inducing a single accurate, robust and comprehensible classifier.

Senthil, Sreenivasa Kumar & Deepak Khemani looked at the problem of adapting temporal plans with durative actions in an environment where the conditions may change during execution.

Redeppa Reddy & Raghavan proposed two new multipath routing techniques, Fail-Safe and Partially-Disjoined Multipath Routing Techniques, which provided efficient fault tolerance towards route breaks and effective traffic load balancing.

Paul Mathew & Sreenivasa Kumar proposed a method of automatically setting up objects from in-coming XML data to greatly facilitate dealing with XML data in object-oriented programs.

Subramanyam & Sreenivasa Kumar proposed new algorithmic techniques to improve the performance of structural join operation used in processing queries over XML data.

Veena Desai, Gonsalves & Hema Murthy explored building of distributed speech recognisers and showed that recognition rates greater than 90% can be achieved with low bandwidths of about 1.6 kbps.

Deepak, Gonsalves & Hema Murthy proposed a design for implementing a security management system for low bandwidth networks.

Electrical Engineering

Prasad Reddy & Swarup have developed a generalized pattern-recognition-based neural network approach in terms of generator and contingency ranking for steady state, dynamic and transient security assessment of power systems.

Srinivasa Rao & Rajagopalan have proposed a fusion framework that statistically combines information acquired from different facial features for achieving good recognition accuracy.

Anmol Sharma & Shanthi Pavan have designed an integrated circuit that generates two DC supplies using only one external inductor incorporating a novel current-mode control algorithm implemented completely in the digital domain.

Marathe Vaibhav Gajanan & Nandita Das Gupta studied the effect of selective anodization on the characteristics of MOS capacitors and developed a model based on pinhole-filling concept to successfully explain the improvement in the characteristics of the devices after anodization.

Manjula, Bhat & Enakshi Bhattacharya fabricated piezoresistive pressure sensors to enable temperature independent operation and proposed a new model for polysilicon resistivity and optimized the doping of polysilicon to get zero temperature coefficient.

Radhakrishnan, Aravind & Harishankar Ramachandran designed and developed a cost-effective fibre-access network for dense urban neighbourhoods with moderate bandwidth requirements.

Management Studies

Nagendra Kumar & Srinivasan have carried out simulation studies on dispatching rules and performance measures in semiconductor wafer manufacturing and developed a method of classifying workstations using a clustering algorithm.

Padma, Ganesh & Rajendran investigated the effects of implementation of the ISO 9001, ISO 14000 and the CMM quality systems on organizational performance with special reference to the Indian manufacturing and software industries as well as the relationships between firm-attributes and critical factors of the quality systems and organizational performance.

Mechanical Engineering

Rathore & Srinivasa Murthy studied the freezing of high viscosity foods like jams and jellies in cans and found that convection in the mushy region plays an important role in deciding the freezing rate and hence the quality of the product.

Ravindranatha Reddy & Venkatarathnam studied two different mixed refrigerant processes that can be used in a single stage cryogenic refrigerator and built a phase separator cycle prototype

Rajendra Prasad, Maiya & Srinivasa Murthy studied metal hydride based heat operated water pumps for both high head–low discharge and low head–high discharge applications.

Vamsi Krishna, Singaperumal & Narayanasamy developed a Micro Electro Discharge machine comprising a smart actuator as tool feed mechanism and a PET based pulse generating circuit and used it to study the influence of process parameters on the process responses in copper and steel specimens, micro structuring of silicon wafers and the formation of Nano particles of more or less uniform size in graphite.

Praveen Kumar & Raju Sethuraman, developed a novel methodology to solve small strain elasto-plastic problems based on pseudo elastic analysis using higher order finite elements and illustrated its effectiveness with reference to various hardening engineering materials.

Suresh Kumar & Ganesan investigated both non-reacting and reacting flow conditions in a three-dimensional model of an afterburner using CFD to help the Gas Turbine Research Establishment, Bangalore to optimize their design of afterburners.

Ravuthu Satyamu, Shet & Sundararajan carried out both experimental and theoretical studies on air-staged combustion with LPG as fuel in a co-swirl burner and analysed numerically the effect of combustion staging on NO_x emissions under varied operating parameters. Near-burner temperature field data were used to validate FLUENT, the commercial code used in the present work.

Harish Dixit & Babu have predicted *ab initio* the mean velocity profile in a turbulent boundary layer using lattice Boltzmann calculation without any turbulence model.

Ramakrishna Raju & Chandramouli have developed a binary indexing technique based on component mode synthesis to reduce the computational burden in periodic structures connected to nonperiodic end structures.

Phani Kiran, Chandramouli & Narayanan identified the statistical energy parameters for welded and riveted joints used in isogrid and stiffened panels in space structures and developed improved techniques for accurate estimation of the SEA parameters.

Krishna Prasad Mandava & Krishnan Balasubramanian, working jointly with Prof. Wiggenger of BAM, Berlin, Germany demonstrated an advanced DSP method for improving the imaging of internal defects in concrete.

Padma Kumar & Krishnan Balasubramanian developed a new method for the measurement of elastic constants of anisotropic thin plates.

Nelanti Krishna & Venkateshan carried out numerical studies on phase change problems – melting and solidification – when the properties of the phase change medium vary significantly with respect to temperature, and highlighted the effect of natural convection on melting times.

Vijaya Bhaskar, Koshy Varghese & Ramesh Babu addressed the issues related to trajectory planning of 2 x 4 cooperative manipulators with algebraic, trigonometric and B-spline techniques, demonstrated the effectiveness of higher order trigonometric splines through several case studies implemented in a virtual work cell developed in IDEAS, and analysed the dynamics of robots in cooperative manipulation of a long object using the ADAMS software.

Senthilkumar & Ganesan analysed the dynamics of conical shells, convergent-divergent nozzles with steady flow.

Ashok Kumar Reddy, Siva Prasad & Shunmugam obtained spur gear profiles by geometric modeling with analytical relations or computer based approach. An Artificial Neural Network, based on back propagation algorithm has been used to train the network to predict the fillet stresses for a given gear tooth geometry to save computational time.

Venkateswara Reddy & Sujatha used a generic algorithm code with improved computational efficiency for optimizing of ride comfort of a passenger car.

Metallurgical & Materials Engineering

Sriraman, Seshadri & Ganesh Sundara Raman synthesized by electrodeposition and characterized nanocrystalline Ni-W and Ni-Fe-W alloys.

Suresh Kumar, Seshadri & Pratap Haridoss synthesized and characterized Ni-Pd catalysts for use in Direct Methanol Fuel Cells (DMFC) taking advantage of the surface segregation observed in this alloy system.

Pani Kishore & Prasanna Kumar incorporated mathematical models of shrinkage porosity of aluminum alloy castings into FLUENT to derive virtual radiographs of the castings.

Padmavathi & Prasada Rao found that laser surface modification of magnesium alloy AZ91C improves both corrosion and wear and that non-chromate conversion coatings were as efficient as chromate conversion coatings in improving corrosion resistance.

Kamsala Devi & Prasada Rao showed that the mechanical properties of Al-6%Cu alloy welds are improved by compressive deformation and by addition of scandium at room temperature.

Ocean Engineering

Arunakumari & Rajagopalan studied the effect of soil-structure interaction on the reliability of offshore jackets.

Manorama & Rajagopalan generated optimal designs for target reliability of large diameter stiffened cylindrical submarine hulls.

Venkata Prasad, Sundar & Sundaravadivelu studied the effects of frequency ratio, wave steepness and relative water depth on the ringing response of vertical cylinder for both regular and random waves and proposed predictive formulae for second and third order forces based on the FNV model.

Naga Sreenivas, Ganesh Babu & Narasimha Rao studied the influence of aggregate on the performance of high strength concrete and developed charts to bring out the pile capacities at various concrete grades.

Anuradha & Narasimha Rao showed that the caissons foundation can be conveniently adopted for mooring dolphins in harbours and proposed methods to estimate the lateral capacities and deflections.

Ravi Challa, Idichandy & Vendhan studied the dynamics of a Space Recovery Module (SRM) during water impact by performing experiments using a 1/6th Froude-Scale model and comparing them with numerical results obtained using an advanced state of the art explicit dynamic finite element code, LSDYNA3D.

Surekha & Ganesh Babu evaluated the reactivity of rice husk ash in concrete through the efficiency concept and proposed an effective mix proportioning methodology.

Shafiuddin Amer Syed & Mani developed a spaced multiple pontoon floating breakwater to provide minimum wave transmission and free surface oscillations in the interspace.

Chiranjeevi Rambabu & Mani evaluated the performance of submerged breakwater in wave attenuation and obtained the optimum configuration for the same.

Hariprasad & Sundaravadivelu carried out studies on the wave forces including slamming effect on twin horizontal circular cylinders due to regular and random waves and extracted different force components analytically and compared them with experiments.

Sachidananda Mishra & Subramanian investigated the application of remote sensing techniques and GIS and use of satellite acquired data to find the impact of beach placer mining and other coastal structures on coastal geomorphology.

3.3 Inter Disciplinary Research Groups

Several interdisciplinary groups were formed in order to synergise the expertise of the faculty in different departments. The groups were formed on the basis of overlapping research interests. A brief description of their research goals and their progress till date are given below.

Biotechnology

The group has 3 projects : (a) A mathematical model has been developed for cellular stress response during the dual-stress conditions of temperature shift and recombinant protein over-expression. Key components of the stress response like transcription factors, chaperones and proteases and their function under stressful conditions have been characterized experimentally. Comparison of the cellular stress response has been carried out for cytoplasmic and periplasmic expression of recombinant streptokinase in *Escherichia coli*. (b) GJ adaptation is found to significantly increase the range of synchronization of autorhythmic cells with different intrinsic frequencies implying that it is probably anti-arrhythmic. It was also shown that the well-known pattern of GJ conductance dependence on junctional voltage is consistent with the proposed adaptation mechanism, adaptive GJs give robustness to cardiac activation dynamics and prolonged external stimulation leads to a persistent change in virtual “ECG”. (c) Mimosine was found to promote growth of the seedlings of *Vigna radiata* at exposure levels of 0.1-0.2 mM. Remarkable increase was noticed in mitochondrial and soluble SOD levels with concomitant enhancement in catalase, peroxidase and ascorbate peroxidase levels. Evidence for mitigation of lipid peroxidation by mimosine was provided by the results.

Chemical Physics and Molecular Biology

The primary research concern is the structure and activity of atoms, molecules, surfaces and solids, as well as bio-molecular systems such as enzymes. A *Time-Correlated Single Photon Counting (TCSPC)* system has been set up around existing equipment with appropriate modular additions, resulting in an order of magnitude enhanced time resolution (now 300 ps) and 0.5 μ spatial resolution for the associated confocal microscopy capability. Excited state energy transfer studies are being undertaken; studies of liposomal drug delivery systems and of cavity quantum electrodynamics are planned.

Communication Technology

The group has set up an Indic Computing Laboratory. Keyboard, speech and handwriting interfaces to the computer (for Indian languages) have been developed. Currently the system supports Tamil. A "sound proof" room for recording voice(s) has also been built. A second area of research is dense wavelength division multiplexed systems, components and networks.

Complex Systems

With several biological and personal-care applications in mind, rheology, structure and flow behaviour of micellar systems are being investigated. Specific systems include ionic as well as non-ionic surfactants and macromolecules.

Development Studies

Five research projects are being carried out covering a vast range of development issues, such as the impact of Pesticides on Human Health, Ethics and Technology Policy, Media and Environmental Awareness, Gender and Entrepreneurial Development, Cost, Quality and Performance of Technical Education.

Energy Technology

The Energy group is working on two specific topics of renewable energy technologies: (a) New solid state hydrogen storage materials such as intermetallics, borates, alanates and carbon nanotubes have been synthesized and tested successfully. Heat and mass transfer optimized design of large capacity hydrogen storage reactors have been carried out. A variety of automotive IC engines have been run on hydrogen on the test bed. (b) "Thermo-Photovoltaics" are being studied for simultaneous production of electric power and heat. Air heating and water heating collectors integrated with transparent PV panels have been tested successfully.

Environmental Technology

Three important issues concerning the environment are being addressed: Municipal Solid Waste Management, Traffic Control Strategies for mitigation of

Environmental Pollution and Localized Waste Water Treatment System Development. In the areas of solid waste management, mini-laboratory scale incineration plant is being developed with effective gas clean-up. In the area of road traffic, control strategies to reduce both air and noise pollution have been proposed. It is also proposed to develop an economical and environmental friendly waste water treatment and reuse technology for schools and small scale laboratories.

Infrastructure Technology

The Urban Infrastructure Systems group concentrates on the use of Information and Communication Technology (ICT) for improving effectiveness in the delivery of infrastructure systems, specifically in the areas of traffic systems, water & gas distribution networks, and power systems.

Instrumentation and Control

With core competence in Control Guidance & Robotics, Process Dynamics & Control, Acoustic, Noise & Vehicle Control, Smart Structures & Micro- Robots, Control of Mechatronic Systems, the research focus is in the areas of Application Intelligent Instrumentation and Control for Process and Productivity Improvement.

Materials Technology

There are six research projects in progress: (a) Nanostructured carbon films and carbon based p-n junctions have been obtained using PLD technique (b) Methodologies for recycling PCB are under development. Mechanical and chemical methods to separate metallic and non metallic constituents have been developed. (c) Ni-Pd catalyst has been synthesized using electrodeposition technique and has been characterized for use in DMFC. (d) A novel processing route to produce boron carbide by carbo-thermic reduction of boron oxide and carbon has been developed. (e) Multi walled, Single walled and alloy encapsulated Multi walled carbon nanotubes have been synthesised by catalyst chemical vapour deposition technique using metal hydrides as catalysts. These CNTs are being used as catalyst support for Proton Exchange Membrane Fuel Cells. (f) Novel alloy hydrides thin films have been used to develop hydrogen sensors.

Micro Electro Mechanical Systems

There are five research projects: (a) A Silicon based Micropump suitable for drug delivery and drug dosage control has been designed for electrostatic operation with voltages below 10Volts. (b) A PDMS (poly dimethyl silioxane) based chip has been fabricated and successfully demonstrated the separation of a 5 μg sample mixture of DNA fragments by electrophoresis. The microchannel dimensions can be easily reduced and the same resolution of separation can be obtained by loading nano-gram levels of DNA. (c) A potentiometric biosensor based on porous silicon for triglycerides and urea, capable of measurements down to 500 micro molar, has been developed for the first time. (d) Extensive design and simulation has been carried out using both analytical models and Intellisuite software and a MEMS shunt capacitive switch, having very low actuation voltage, low insertion loss, and high isolation has been designed. (e) Simple cantilever beam MEMS test structures with polycrystalline silicon have been fabricated and tested for estimating the Young's modulus of the material.

Measurement, Testing and Diagnostics

This group has 5 projects: (1) measurement of (a) unburned fuel concentration in the combustion zone using the planar laser-induced fluorescence (PLIF) technique and (b) 3-components of velocity in a plane in a flow field using stereoscopic particle image velocimetry (stereo-PIV). (2) microscopic and macroscopic imaging of the internal structure of materials using microwaves (3) developing measurement techniques using transient heat "waves" to see inside engineering materials and structures and measure the quantitative state such as presence of cracks, voids, corrosion, hydride attack (4) perform quantitative gait to objectively document walking ability as well as identify the underlying causes for walking abnormalities in patients with cerebral palsy, stroke, head injury and other neuromuscular problems. (5) Femto-second laser based measurement of chemical and physical phenomena.

Methodologies

Among the main areas of current study are the application of Finite Point Set method to understand wave interactions with porous media and the application of graph theoretic techniques to understand the molecular structure and stability of fullerenes.

Quality Assured Design & Manufacturing

This project aims at damage tolerant design and materials, macro-and micro-mechanical machining, and modeling and system simulation to assure quality in design and manufacturing.

4. ACADEMIC DISTINCTIONS SECURED BY OUR FACULTY MEMBERS AND STUDENTS

Several academic distinctions - Honours and awards, Fellowships of Professional societies, Memberships on Editorial Boards of Journals, Books and Monographs, Patents - have been bestowed on our faculty, staff and students in recognition of their academic achievements during the current year. Some of these are listed below:

Awards :

Dr. E. G. Tulapurkara Aerospace Engg.	Excellence in Aerospace Education by the Aeronautical Society of India
Dr. T. Pradeep Chemistry	CRSI Bronze Medal for contributions in Chemistry
Dr. K. P. Sudheer Civil Engg.	INAE Young Engineer Award 2004 by the INAE
Dr. Ashok Jhunjhunwala Electrical Engg.	27 th IETE Ram Lal Washwa Gold Medal Award by the Institution of Electronics & Telecommunication Engineers UGC Hari Om Ashram Trust Award by UGC Skoch Summit Challengers 2005 Award by Business India
Dr. K. N. Bhat Electrical Engg.	Rashtriya Gaurav Award by India International Friendship Society

Dr. V. Ganesan Mechanical Engg.	State Level Periyar Award for the best Engineering College Teacher in Tamil Nadu and Pondicherry by the Indian Society for Technical Education, Tamil Nadu and Pondicherry Section Khosla National Award by IIT Roorkee
Dr. K. Gopinath Mechanical Engg.	Alumni Excellence Award by NIIT Surathkal
Dr. B. S. Murthy Metallurgical & Materials Engg.	National Metallurgist of the Year Award by the Indian Institute of Metals
Dr. V. Sundar Ocean Engg.	Rashtra Prathibha Puraskar Award by the Integrated Council for Socio-Economic Progress
Dr. M. S. Ramachandra Rao Physics	Certificate in recognition of Excellent Achievements in Science Education Outreach by the UMD-NSF Materials Research Science and Engineering Centre (MRSEC), University of Maryland
Dr. Harish Chandra Librarian	Best Technology Librarian 2004 by The Delhi State Booksellers' and Publishers' Association

Fellowships

Dr. A. K. Mishra Chemistry	Fellow, National Academy of Science
Dr. S. Srinivasa Murthy Mechanical Engg.	Fellow, American Society for Mechanical Engineers
Dr. C. Balaji Mechanical Engg. Dr. Shamit Bakshi Mechanical Engg.	Humboldt Fellow

Membership of the Editorial Boards

Dr. Mukesh Doble Biotechnology	Member, Editorial Board, Journal of Chemical Engineering, USA
Dr. G. Sundararajan Chemistry	Editor Regional, Molecules, Switzerland
Dr. B. Viswanathan Chemistry	Member, Editorial Board, Eurasian Chemico-Technological Journal, Kazakhstan
Dr. P. R. Parthasarathy Mathematics	Advisory Editor, Journal of Statistics and Management Systems, India
Dr. S. H. Kulkarni Mathematics	Guest Editor, Journal of Analysis, Vol.12, India
Dr. V. Vetrivel	Member, Editorial Board, Journal of Functional Analysis

Mathematics	and Approximation Theory, Germany
Dr. R. Krishna Kumar Mechanical Engg.	Editorial Board, International Journal of Mechanics of Advanced Materials and Structures, USA
Dr. Sarit Kumar Das Mechanical Engg.	Member, Editorial Board, International Journal of Heat Transfer Engineering, USA
Dr. T. Sundararajan Mechanical Engg.	Associate Editor, Computers, Materials and Continua, USA
Dr. Harish Chandra Librarian	Member, Editorial board, International Journal of New Review of Information Networking, USA
Dr. S. Narasimha Rao Ocean Engg.	Member, Editorial Board of the Geotechnical Testing Journal, USA
Dr. S. Srinivasa Murthy Mechanical Engg.	Member, Editorial Board, Journal of Energy, Heat and Mass Transfer, India Member, Editorial Board, International Journal of Low Carbon Technologies, India Associate Regional Editor, International Journal of Applied Thermal Energy, UK Member, Editorial Board, Innovative Refrigeration and Airconditioning, India
Dr. V. Ganesan Mechanical Engg.	Member, Indian Journal of Engineering and Materials Science
Dr. C. Sujatha Mechanical Engg.	Member, Indian Journal of Transport Management Member, Advances in Vibration Engineering, India
Dr. T. S. Sampath Kumar Metallurgical Engg.	Associate Editor, Trends in Biomaterials and Artificial Organs, India
Dr. V. Sundar Ocean Engg.	Member, Indian Journal of Marine Sciences

Books

Dr. S. Radhakrishnan Dr. Megha Singh	Advances in Medical Diagnostic Techniques and Procedures, Anamaya
Dr. Mukesh Doble	Biotransformation and Bioprocesses, Marcell Dekker
Dr. M. Chidambaram	Basics of Data Acquisition and Control in Handbook of Networking, Springer Verlag
Dr. B. Viswanathan	Practical Physical Chemistry, VIVA Books
Dr. John B. Lourdusamy	Science & National Consciousness in Bengal 1870-1930, Orient Longman
Dr. S. C. Chaudhary	Better Spoken English, Vikas English for Engineering Students Vol.I, Vikas
Dr. S. P. Venkateshan	A First Course in Heat Transfer, M/s. ANE Books
Dr. S. K. Das	Process Heat Transfer, Narosa

Best Paper / Thesis / Design Awards :

M. Akhila Maheswari Ch. Siva Kesava Raju Chemistry	Best Paper of International Standards Award at the National Symposium on Nuclear and Radiochemistry (NUCAR-2005)
E. Rajasekar Dr. A. Ramachandraiah Civil Engg.	One of the Best Papers at the National Symposium of Acoustics
K. Srividya Civil Engineering	ISTE National Award for the Best M.Tech. Thesis in Civil Engineering for the year 2004 by ISTE
Dr. S. R. Gandhi Civil Engineering	IGS - Smt. Indra Joshi Biennial Prize for the Best Paper published in National / International Conferences 2004 by IGS
B. S. Manoj Computer Science & Engg.	IBM outstanding Ph.D. Research Award by IBM
S. Jayashree B. S. Manoj Dr. C. Siva Ram Murthy Computer Science & Engg.	Best Paper Award in Systems at the 11 th International Conference on High Performance Computing (The Award carries a citation and a cash prize of Rs.25,000)
A. Pavan Kumar Dr. V. Kamakoti Dr. Sukhendu Das Computer Science & Engg.	First Prize at the SOPC World Design Contest 2004
Vinod Pathangay Dr. Sukhendu Das Computer Science and Engg.	Best Paper at the National Conference on Image Processing
G. V. Subramanyam Dr. P. Sreenivasa Kumar Computer Science & Engg.	Best Student Paper Award at the 11 th International Conference on Management of Data
Shri Roy Paily Palathinkal Electrical Engg.	IBM outstanding Ph.D. Research Award by IBM
Dr. Debashis Acharya Humanities & Social Sciences	Best Paper Award at the International seminar on Globalisation and Competitiveness
Mr. Aveek Majumdar Humanities & Social Sciences	Best Paper Award in Retail Management at the International Conference on Services Management
S. Radha Dr. Thenmozhi Management Studies	Best Paper Award at the National Conference in Business Research
K. Ganesh Dr. T. T. Narendran Management Studies T. Godwin Ram Gopalan Dr. T. T. Narendran	Best Paper Awards at the VIII Annual International Conference of the Society of Operations Management

Management Studies V. Nagendra Kumar Dr. G. Srinivasan Management Studies	
Dr. R. Madhumathi Management Studies	Dhainik Bhaskar Best Applied Research Paper Award at the International Conference on Banking and Insurance
Dr. V. Ganesan Sunil V Unaune Mechanical Engg.	N. K. Iyengar Memorial Prize for best paper published by the Institution of Engineers
Dr. G. Venkatarathnam Mechanical Engg.	Best Technical Paper at the 27 th National Symposium on Industrial Gases
Dr. V. Ganesan M. Sivakumar Mechanical Engg. Dr. V. Balasubramanian, UCAL Systems	SVRCET Surat Prize for Best Paper at the 31 st National Conference on Fluid Mechanics and Fluid Power
M. Sireesha Dr. Shaju Albert Dr. S. Sundaresan Metallurgical & Materials Engg.	KCP Award for Best Paper on Welded Fabrication at the International Welding Conference
Dr. B. S. Murthy Metallurgical & Materials Engg.	Binani Gold Medal Award for best paper published in the Transactions of the Indian Institute of Metals in the year 2003-04
A. N. Suryanarayana Prasad Ocean Engg.	The K. Suryanarayanan Rau Memorial Senior Student Award for Research and Development in Smart Technology – 2004 by the Indian Society for Advancement of Materials and Process Engineering (ISAMPE)
Dr. V. Sundar Ocean Engg.	Maritime Award for research paper by the Union Minister for Shipping, Road Transport and Highways

Patents Filed

Dr. K. M. Patil Applied Mechanics	A novel diabetic footwear for prevention of foot sole ulcers (filed by M/s.Sundaram Medical Foundation) Portable Pedopowergraph
Dr. Anju Chadha Biotechnology	A process for the Monoacylation of Polyols with Alkyl & Aryl B-Keto Esters
Dr. T. Pradeep Chemistry	Polyurethane Foam Coated with Silver Nanoparticles Flow Induced Potential in Nanoparticles Assemblies Solution Phase Room Temperature Synthesis of C60 promoted by nanoparticles

Dr. B. Viswanathan Chemistry	An Improved Process for the preparation of polylactic acid (filed by Malladi Drugs and Pharmaceuticals Ltd.)
Dr. G. Venkataratnam Mechanical Engg.	A Refrigerant composition for a single stage refrigerant system (containing Inobutne) A Refrigerant composition for a single stage refrigerant system (containing Propane)
Dr. Krishnan Balasubramaniam Mechanical Engg.	Method of Automated detection and removal of hard contaminants in soft materials such as cotton
Dr. T. S. Sampath Kumar Metallurgical & Materials Engg.	A Novel Method for Processing Boron Carbide Powders
Dr. S. K. Seshadri Metallurgical & Materials Engg.	A Process for the preparation of Wear & Corrosion resistant coatings for electrodes deposition on metal substrates
Dr. Prem B. Bisht Physics	A new technique for dye concentration sensing by microspheres

5. INDUSTRIAL CONSULTANCY AND SPONSORED RESEARCH

Industrial consultancy not only provides technological solutions towards industrial development, but also brings a sense of relevance to the teaching-learning processes. Sponsored research is an important part of IITM's activities. Since 1973, we have maintained a steady and sustained growth in our interaction with industry and other agencies, both in terms of the number and value of sponsored research and consultancy projects. The number of active sponsored projects during the year is 79 for a total value of Rs.352 millions including 8 international projects for a value of Rs.89 millions and 26 large projects of value exceeding Rs.2 millions each; the number of faculty members involved in these projects as Principal Investigators and Co-principal Investigators is 94.

The number of active consultancy projects during the year is 452, for a total value of Rs.84 million including 53 Research Based Industrial Consultancy projects for Rs.42 million. The number of faculty members involved in these consultancy projects is 117 while 9 have been retained as consultants in various industries at a cost of Rs.1.38 million. The ISRO-IITM Space Technology Cell renewed 8 projects and sanctioned 13 new projects during this year. Under the IGCAR-IITM Cell, 2 new projects have been initiated. Periodic monitoring and review of these projects are the major responsibilities of these Cells.

The Industrial Associateship Scheme has now 231 members facilitating continuous interaction with industry. The Centre for IC & SR organized 7 Technology Appreciation Programmes for the benefit of these Industrial Associates during the current year. We have signed 23 Memoranda of Understanding during the year under review with industries such as JK Tyres, Eureka Forbes Limited, Texas Instruments (India) Private Ltd., Satyam Computer Services Limited and Lakshmi Ring Travellers Limited.

The establishment of a technology R&D park has made further progress with the allocation of land to the extent of 6.5 acres by the Government of Tamil Nadu to IIT Madras. This land is adjacent to Tidal Park across the road from IIT. The plan is to set up a 100,000 sq. ft. facility, which will rent out space to industries that have R&D collaborative projects with IIT and incubate companies initiated by the faculty and students of IIT Madras. It is hoped that this park will increase the meaningful interactions between IIT Madras and the industry and contribute significantly to increase the competitiveness of the Indian industry.

The Centre for IC & SR publishes Quarterly Reports of the activities of the Institute in an attractive format under the banner of *IIT Madras News*, in addition to the release of regular Newsletters. A CD has been prepared highlighting the several facilities and activities of the Institute.

6. CONTINUING EDUCATION

The Centre for Continuing Education (CCE) has been very active in promoting activities for the benefit of working professionals in industries and faculty members of other technical institutions. During the year, our faculty members organized several courses/training programmes: 10 under the Quality Improvement Programme, 52 under Continuing Education and 2 under ISTE. The CCE generated a revenue of Rs. 74.35 lakhs during the year.

The Centre encourages other activities such as preparation of computer aided instructional packages and production of technical video programmes. During the year under review, a major thrust has been given to development of web based course materials. A Web Studio has started functioning mainly to web-enable many courses. Under the Book Writing Scheme, 3 proposals have been received. Five books have been published.

The Educational Technology Cell's studio equipment has been upgraded from Analog to Digital, serving the needs of many research projects and multimedia CD ROM projects. Conversion of the available material in tape format to CD ROM format is in progress. About 600 hours of video material is being disseminated to various colleges and R & D establishments at a subsidised rate. This year's activities also include: 172 Semester programmes, 125 laboratory shoots, 1250 hours non-linear editing and 90 hours LCD projections.

7. OUR CONTRIBUTIONS TO THE NATIONAL S&T EDUCATIONAL SYSTEM

IIT-Madras plays a lead role in providing guidance and assistance to the other Engineering Institutions in the country. We have been implementing the Quality Improvement Programme (QIP), which provides opportunities for teachers of engineering colleges to upgrade their qualifications towards Ph.D. and M.S.. Under the QIP, 394 faculty from other institutions have obtained their Ph.D. degrees and 472 faculty from other institutions have obtained their M.Tech. degrees since its inception. Currently we have a total of 144 QIP Scholars (77 Ph.D. 67 M.Tech. which includes 4 women in Ph.D. and 20 women in M.Tech) in the Institute.

The All India Council for Technical Education, including the National Board of Accreditation, has been utilizing the expertise of our faculty members in several of their Committees and activities. Many of our faculty members are also on the Governing Councils of several S & T institutions in the country. CCE assists AICTE in the selection process of candidates for the Early Faculty Induction Programme scheme and in 2004, 165 candidates have been selected under this scheme.

The National Programme on Technology Enhanced Learning (NPTEL) project involving all the IITs and IISc co-ordinated by IITM has been funded by MHRD. NPTEL partners in India will jointly put 300 courses on the Web within the next year. These courses will be made available by June 2006 at highly subsidized rates to all engineering and management institutions in India, thus enhancing the reach and quality of technical education in the country.

IIT-Madras has been playing a lead role in the design of activities towards IIT-NIT Networking. The activities proposed include joint projects, faculty and student exchange, and joint activities such as workshops, seminars, etc. The Summer Fellowship Scheme, which was initiated a few years ago, provides opportunities for

summer training to top-ranking engineering and science students all over the country; 73 students participated in the programme this year.

8. INTERNATIONAL COLLABORATION

IITM has been interacting with several International Organizations for collaborative research, exchange of faculty and students, etc. During the year, we have signed MoUs with the following 10 international universities: University of Maryland System and the John Hopkins University, University of Waterloo, Concordia University, University of North Carolina, University of Nebraska- Lincoln, Indo-Swiss Academic Alliance, University of Vienna, Technical University of Hamburg, Hyogo University, New Mexico Tech..

With these, the total number of MoUs signed by IIT-Madras with international universities amounts to 65. We have also signed 6 MoUs with International Companies and Research Laboratories for collaborative R & D.

During the summer, a number of faculty members from the Institute visited universities and research laboratories abroad for collaborative research, participation in conferences, visiting assignments, lectures, consultancy, etc.

9. INTERNATIONAL STUDENT EXCHANGE PROGRAMMES

Over the past few years, the Institute has created several opportunities for International Student Exchange. One of the major initiatives in this regard is the Indo-German Agreement between the seven IITs and seven Technical Universities in Germany. Under this Programme, we have deputed 14 M. Tech. students and 3 M. S. scholars to undertake their project / thesis work in these German Universities last year. We have also received a few Ph.D. and Dipl.-Ing. scholars from Germany to undertake their projects in our research laboratories. Under the MoU with EPFL, 15 students from EPFL did their course work in IIT-Madras for two to four months. 5 Ethiopian students joined the M.Tech. programme in this Institute in August 2004.

10. CAREER DEVELOPMENT AND WELFARE SCHEMES FOR THE EMPLOYEES

HR training has been planned and implemented for providing opportunities to our technical and administrative staff to update and upgrade their knowledge and skills, in order to enable them to perform their work more effectively. Under this scheme, 26 training programmes (166 programme-days) covering 259 staff / faculty

members were conducted during the year. Special Programmes were conducted on Interpersonal Effectiveness, Communication Skills, Computer Skills, Teamwork etc.

11. OUR QUALITY INITIATIVES

We are setting up Visiting Committees for the various Departments of our Institute, on the lines of the best practices obtaining at leading institutions world-wide. The Visiting Committee for Aerospace Engineering completed their visit and has provided us valuable inputs this year.

IIT-Madras has been awarded ISO-9000 certification for academic and support processes since 1999 and for administrative support processes since 2001. The administrative support processes have been recertified in April 2005 while recertification for the academic support processes is due in September 2005. In addition to the ISO 9001:2000 certification, the Central Electronics Centre has also received the NABL Accreditation for its Testing and Calibration Laboratories.

12. INFRASTRUCTURE DEVELOPMENT

Significant additions have been made to the infrastructure in the Campus. The IBM main frame has been upgraded to P690 series, with 64 CPU, 128 GB RAM and 4 Terabytes of disk space. Two Sunfire Enterprise Servers with 64 CPU 128 GB RAM and 4 Terabytes of disk space in each have been acquired for e-learning and digital library management for the country. Two SGI 350 Altix series high end computing servers each with 16 itanium processors, 32 GB RAM and 2 Terabytes of disk space for computation and graphics capability. The entire hostel area has been networked connecting all the hostel rooms to the rest of the Campus and the rest of the world. Each student's room is equipped with direct access to Campus-wide computer facilities, Internet and a telephone with Direct Inward Dialing (DID) facility. Each hostel common room has been equipped to cater to the computing needs of those who cannot afford computers in their respective rooms.

A 100 seater Digital Knowledge Centre (DKC) based on Thin Client Technology has been established in the Central Library to enable students to access e-journals. A state-of-the-art Data Centre facility has been established. It is populated with 30 Intel Xeon CPUs in dual/quad formation with 1:2 GigaByte memory and 6 Terabytes of storage. A Record Room has been created which houses all the physical records of the Institute for periods ranging from 5 to 10 years

depending on the administrative requirements. Meanwhile digitisation process to capture the last 50 years of IIT Madras in electronic form is at the final stage of completion. The concept of the work flow has been adopted for launching Institute wide administrative applications. A sample for the Stores and Purchase Section has been created. The Institute Wide ICE Information System based on IITM portal will enable on-line access to the Data base cutting across the entire Institute.

A Smart Card which is capable of carrying information in itself and enabling access to various facilities has been finalized and is being issued shortly to faculty, staff and students. These cards will regulate access to Library, the swimming pool and will soon enable the students to access messing facilities and the computer facilities across the Campus.

The Class Room Complex consisting of 3 halls of 194 student-seating capacity and 10 halls of 105 seating capacity has been acoustically treated, electronically enabled, and internet connected. Further, the three large halls are video-integrated – that means a lecture being delivered live can be seen in the other two large halls in “video-live” mode. 45 class rooms of the Institute have been modernised with LCD projectors and computer systems with all necessary softwares. Network connection has also been given in the class rooms. The ambience of the class rooms have also been improved considerably.

Several major works have been completed : networking of residential zone; deepening of approach canals of the lake for rainwater harvesting; construction of 3rd floor in Jamuna and Godavari Hostels; improvement of student rooms at Brahmaputra, Narmada, Alakananda, Tapti and Saraswathi hostel, construction of quarters for married research scholars; renovation of swimming pool; a new ward complex in the hospital with 12 single rooms; modifications to house a physiotherapy unit and a pharmacy.

Three additional floors have been made operational in the Central Library with the back volumes, reference collections, students discussion hall, Media resource center and a separate place for reports, collections on IPR. In addition to this, Central Library has also implemented VTLS Virtual International Library Management Software with Digital Library Interface with iPortal facilities for

searching for books. Large numbers of e-Journals have been subscribed to and can be accessed on the campus network by the faculty, students and staff.

The following major constructions will be completed by December 2006 : new boys hostel G+6 floors (4 blocks); Mega Dining facility – II and Bio-Technology building; addition of a floor and major modification of the old library building to house the department of Management Studies; crèche; addition of 11 suites to the Main Guest House.

13. STUDENT CO-CURRICULAR AND EXTRA-CURRICULAR ACTIVITIES

The academic year 2004-05 has been remarkable as far as the co-curricular and extra-curricular activities of our students are concerned. Eminent personalities from all walks of life addressed our students in the Extra Mural Lecture series and these after dinner lectures and the lively discussions that follow are becoming very popular among students.

The annual technical festival SHAASTRA held during October 5th to 9th 2004 attracted student's participation from all over the country. The Quality Management system in place for the conduct of Shaastra has been awarded ISO 9001 making it perhaps the first student festival in the world to get the certification. The Industrial Design Problem contest and the Robotics contest, introduced this year were hits. Popular lectures, video conferences, workshop and a number of formal and informal events make Shaastra one of the major technical festivals of the country.

SAARANG held during January 21st to 26th January 2005 attracted thousands of students from the length and breadth of the country. This year all professional shows had record crowds. Being sensitive to the Tsunami victims, IIT Madras contributed a sum of 5 lakhs towards the TN Chief Minister's Tsunami Relief Fund out of the Saarang budget.

Participation of our students in various Inter university technical and cultural festival has been on the increase and every team left their mark wherever participated. The 2nd TCS-IIT Madras Open Quiz 2005 was organized this year on 12th March which attracted teams from all over the country. There were about 100 college teams, 35 school teams from various city schools and about 75 teams of experienced veteran quizzers. In the 40th Inter IIT Sports Meet held during December 2004 at IIT Madras, both the Men's and Women's General Championship

were won by our students team and Mr. Raghuveer was adjudged the Best Athlete. All our sports facilities, were given face-lift and many outdoor courts flood-lit. Swimming pool has been renovated. Because of the improvements in all sports facilities participation by students has improved considerably compared to previous years.

Since last year, IIT Madras has started a series of lectures by eminent people under the title 'Perspectives in Science & Technology'. Eminent persons in different fields are invited to spend a few days on the campus giving technical as well as general talks as well as holding discussions with faculty and students of IIT Madras. So far, we have had two visitors Prof. V. S. Ramachandran, Director, Center for Brain and Cognition and Professor of Neurosciences and Psychology, University of California, San Diego and Prof. Hartmut Michel, Max Planck Institute of Biophysics, Frankfurt, Germany. We expect to have Prof. Jagdish N. Bhagwati, Columbia University, New York next year.

14. SOCIALLY RELEVANT ACTIVITIES

IIT Madras initiated activities for transfer of technologies, which are of immediate relevance to the society. For this purpose, the following three projects have been taken up.

Socially Relevant Projects is an initiative of IIT Madras. Under this initiative, a metal-free, non-toxic organic polymer based phosphate-binding agent was developed at the Department of Chemistry, IIT Madras and the technical know-how was transferred to a pharma company. This product (FOSEAL) will soon be available to renal patients in India at an affordable cost. Other projects are under progress.

IITM has launched two projects with the participation of the entire campus community with the Ladies Club taking the responsibility for their implementation. The Zero Waste Zone (0WZone) project has employed three self-help groups to collect the solid waste on campus on a daily basis and segregate it into organic and non-organic parts. The organic part is returned to the forest areas as manure while the non-organic part is further segregated into various disposable forms of solid waste. The latter is sold every month and the proceeds are distributed as incentive to the self-help groups themselves. The Atma Charity Wing (ACW) conducts a ticketed charity show every year in September in order to raise funds in support of charitable

organizations in the vicinity of Chennai. This annual fund-raiser receives voluntary support from faculty, staff, students and alumni.

IIT Madras as a partner in the Rural Technology Action Group, initiated by the Principal Scientific Advisor to the Prime Minister, has identified a few projects for improvement in product quality such as Natural Drugs, Coir Spinning Mills, Solar Powered LED based Lamps, Ankle Support for artificial foot. It is also in the process of identifying technologies for Drinking water supply through water harvesting of surface waters, waste water treatment, energy requirement, technologies for poverty alleviation, sanitation complexes and data bases.

Recognition and Mentoring Programme by Lemelson Foundation (USA) is a novel programme to encourage innovators to come up with inventions to aid rural development has been jointly set up by IIT Madras and Rural Innovations Network, with the funding from M/s. The Lemelson Foundation Recognition and Mentoring Programme (L-RAMP). L-RAMP will provide with technical and financial support to innovators with ideas, which will be commercially viable and cater to the market needs. L-RAMP's network would also promote innovations across the country. IITM has already identified 10 viable innovative products.

15. ALUMNI MATTERS

Our Institute has so far awarded a little over 27000 degrees, ranging from Ph.D. to B.Tech. The education and training our alumni have received at the Institute have enabled them to launch themselves into professionally satisfying and successful careers. They have distinguished themselves professionally, and many of them occupy top positions in the Industry, Government and the Academe. Since 1997, we have been honouring selected alumni for their accomplishments through the Distinguished Alumnus Awards. I am happy to announce that the Awardees for this year are:

1. Dr. A. Parasuraman
Professor and Holder of James W. McLamore Chair in Marketing
University of Miami, USA
2. Dr. A. Jayakrishnan
Scientist G & Head, Polymer Chemistry Division
Sree Chitra Tirunal Institute for Medical Sciences & Technology, India

3. Mrs. Meena Mutyala
Vice President, Nuclear Fuel Engineering Div.
Westinghouse Electric Company
Pittsburgh, USA
4. Dr. Parimal R. Desai
Vice President, Chemical & Pharmaceutical Development
Wyeth Research, New York
5. Mr. Krishna Kolluri
Executive Vice President
Juniper Networks Inc., USA
6. Dr. Kris Venkat
Chairman of Morphochem Inc., Transvivo Inc., Automated Cell Inc, &
Sundari Enterprises, USA

The Office of Alumni Affairs coordinates the interaction between the Institute and the Alumni. In addition to the parent Alumni Association on Campus, we have several Chapters within the country and abroad. The 1980 batch will celebrate its Silver Reunion this year.

The alumni of all IITs have come together to form the PAN IIT organization. During the last year, two PAN IIT Conferences were organized one at New Delhi in December 2004 and another at Washington DC in May 2005. There were about 2000 participants at each of the conferences.

A major fund raising drive called the IIT Madras Growth Fund under the Chairmanship of Mr. S. Gopalakrishnan, COO of Infosys was launched during the year. The funds raised will be utilized towards upgrading research and infrastructure in the campus.

16. ACKNOWLEDGMENTS

For all the achievements and accomplishments enumerated in this report, several people and agencies are responsible - our faculty, students and staff; agencies and industries sponsoring R&D and consultancy projects; professionals from other organizations who have assisted our Institute in several of our endeavours; and our alumni. The Institute is grateful to the Ministry of Human Resource Development, Government of India, for its continued and sustained support. I also wish to thank Dr. K. Kasturirangan, our former Chairman and Dr. A. E. Muthunayagam, our present Chairman for their valuable guidance and

encouragement. We look forward to reaching new heights of achievement in all our endeavours with the able guidance of our Board of Governors headed by our dynamic and visionary Chairman.

I would like to take this opportunity to wish each and every one of our Graduands a successful professional career full of prosperity, happiness and job satisfaction.