Presentation to NBA Team of Experts

B. Tech. programme in

METALLURGICAL & MATERIALS ENGINEERING

Head, Dept. MME, NIT TRICHY

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(60 pages)

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MME NBA Presentation: OUTLINE

- **Warm welcome** to the NBA Team of experts
- **Thanks** to the entire departmental team working for NBA visit
- Vision, Mission of the Institute
- Vision, Mission of the Dept. of MME

- Introduction to the department and the deptl. faculty

- Academic details of the BTech MME programme

- Accomplishments of our wonderful BTech MME students

- Activities of the Faculty – research, projects, publications, societal role

- Recent initiatives within the department

- Concluding Remarks

Vision, Mission of the Institute

- **Vision of the Institute**
  - To provide valuable resources for industry and society through excellence in technical education and research

- **Mission of the Institute**
  - To offer state-of-the-art undergraduate, postgraduate and doctoral programmes
  - To generate new knowledge by engaging in cutting-edge research
  - To undertake collaborative projects with academia and industries
  - To develop human intellectual capability to its fullest potential

Vision, Mission of this dept.

Vision of the Department MME

- To evolve into a globally recognized department in the frontier areas of Metallurgical and Materials Engineering

Mission of the Department MME

- To produce Metallurgical and Materials Engineering graduates having professional excellence
- To carry out quality research having social & industrial relevance
- To provide technical support to budding entrepreneurs and existing industries

Moving On

- Hope to offer you food for thought, in the context of BTech MME programme;
- A more appetizing lunch, of course, would be available in the guesthouse, after this presentation

APERITIF, shall we say (hope no tiff!)

- **INTRODUCTION to the department and the departmental faculty**

- Historical note
- Faculty of Eminence
- Brief information on faculty
- Infrastructure

Dept. MME – Historical Note

- REC Trichy: Year 1963
- Now, celebrating the **GOLDEN JUBILEE**
- Dept. MME: Year 1967

- Initially, UG progamme in Metallurgical Engineering; then added PG in Welding Engg; and then PG in Materials Science; recent addition PG in Industrial Metallurgy; also having MS and PhD programmes
- UG programme then re-christened BTech MME

- Enhancement of annual student intake in BTech MME, from 40 to 62

Dept. MME: Faculty of Eminence

Many eminent personalities, including:

- Prof. **S. Sundaresan**, an expert in welding metallurgy
- Prof. **N. Dakshinamoorthy**, an expert in minerals and geology
- Prof. **V. Sivan**, an expert in corrosion (also Director i/c, 2010) (and an NMD Awardee)
- Prof. **K.S. Pandey**, an expert in powder forging (also Director 2005 – 2010, MANIT Bhopal)
- Prof. **T. Srinivasa Rao**, (presently Director, NIT Warangal)

- **Prof. S. Sundarrajan**, an expert in foundry technology (and present Director of NIT Trichy) (and an NMD Awardee)

Dept. MME: Faculty

- **Professors** – 5 + 1 (lien)
- **Associate Professors** – 5
- **Assistant Professors** – 3
- All with PhD
- PhD degrees typically from IITs / NITs
- **Temporary Faculty** (Contract) – 7 (including 3 with PhD from IITs)

- **INAE DVP**: Dr. S. Suresh, GM (retd.), WRI
- **INAE DVP**: Dr. G. Rajasingh Thangadurai, DRDL
- Total of 23 – the number of sanctioned posts vide MHRD
- (INAE DVP designate: a leading metallurgist from DMRL)
  - And many **guest faculty / invited speakers**

Dept. MME: Brief Information on Faculty

- S/Sri

1. S. Sundarrajan: PhD (IIT Madras);
2. Foundry metallurgy; strategic materials and processes;
3. K.S. Pandey: PhD (IIT Roorkee); Powder metallurgy, Metal forming
4. S. Natarajan: PhD (REC Trichy); Corrosion, Surface engineering
5. T. Srinivasa Rao: PhD (REC Trichy); Powder metallurgy, foundry processes
6. V. Muthupandi; PhD (IIT Madras); Welding, Characterization
7. S. Raman Sankaranarayanan: PhD (Drexel); Process metallurgy, Process modeling
8. V. Surianarayanan: PhD (IIT Madras); Creep, Composites
9. B. RaviSankar: PhD (PSG Tech., Coimbatore); Metal forming, Design
10. S.P.Kumaresh Babu: PhD (NIT Trichy); Foundry metallurgy, Process metallurgy
11. S. Kumaran: PhD (NIT Trichy); Powder metallurgy, Nano materials
12. S. Muthukumaran: PhD (BIT Mesra); Welding, NDT
13. N. Ramesh Babu: PhD (IIT Madras); Bio materials, ceramics
14. K. Sivaprasad: PhD (IIT Madras); Metal forming, Characterization
15. S. Jerome: PhD (NIT Trichy); Welding; Composites

Dept. MME: Information on Faculty – contd.

- S/Sri:

1. A. Joseph Berkmans, Ph.D (IIT Madras), CNT, TEM Expert
2. R. John Felix Kumar, Ph.D (IIT Madras), Electrochemistry, Fuel Cells
3. S. Ramakrishnan, M.S (IIT Madras), PEM Fuel Cell, CNT
4. Anand Chairman, M.Tech (NIT Trichy), Surface Engineering, Composites
5. B. Thirumaran, M.S (NIT Trichy), Corrosion, Surface Engineering
6. Naveed Hussain, Ph.D (IIT Bombay), Metal forming, Surface Engineering
7. Goutham Prakash, M.Tech (IIT Madras), Metal forming, Flame spray synthesis

DVP: DR. S. Suresh: PhD (IIT Madras); Welding; Failure analysis

DVP: Dr. G. Rajasingh: PhD (IISc Bglr); Composites; Aerospace

Dept. MME: Faculty Strength

- In the mid 1990's: 13 posts in this dept
- Couple of rounds of recruitment, after becoming "NIT"
- Recruitment of Adhoc Faculty – last couple of years
- **Increased rigour in the selection process**, for adhoc – an indication of our commitment to the teaching learning process
- Advt. released April 16, 2014 for faculty recruitment

- Recent efforts to utilize schemes such as the INAE DVP

- Strategies being used to enhance teaching resources? – guest lectures; efforts to rope in Visiting Faculty and Adjunct Faculty; process to be implemented shortly

Dept. Infrastructure

- Location of department
- Class Rooms
- The antique / heritage classroom of REC is with MME
- Rooms – for faculty, scholars
- Laboratories
- Dept. Library
- Dept. Committee Room
- Dept. Seminar Room

“META”


உலோகவியல் மற்றும் பூலப்பொருள் பொறியியல்
धातुकर्म एवं पदार्थ अभियांत्रिकी
METALLURGICAL & MATERIALS ENGINEERING

META: The road to success; please join us

META: another perspective!

Process Metallurgy LAB – the youngest! And the “oldest”

Mechanical Testing LAB – the hard work

Metallography / Microscopy – Close look at things

Electron Microscopy – Getting very close!

P/M LAB: Fine, compact and getting heated!

Process Modeling LAB

- Different approaches to modeling, in the context of metals and materials
- Systems, workstations, technical software and material databases
- Modeling of welding processes
- Modeling of casting processes
- Modeling of thermodynamic aspects
- Modeling of metal forming
- Process Modeling elective, offered for some batches

APPETIZER

- Academic Details of the BTech MME programme

- Programme Duration; credits; types of courses
- PEO, PO, CO….
- Mapping of courses
- Evolutionary process: design of curriculum and courses
- Targets and actuals, for some metrics

- Student Placement
- Mentoring of Students

MME: Programme details

- Programme Duration; credits; L T P C;
- Split up wrt I year and II, III, IV years
- Indicative data on core and electives
- Input from other depts?

- Modifications for some batches? – indicative data

PEO, for BTech (MME)

- I. Choose their careers as practicing Metallurgical and Materials engineers in traditional Metallurgical and Materials industries; as well as in expanding areas of materials, environmental and energy-related industries.
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- II. Engage in post-baccalaureate study and make timely progress toward an advanced degree in Metallurgical and Materials engineering or a related technical discipline or business.
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- III. Function effectively in the complex modern work environment with the ability to assume professional leadership roles.

PO

- (1) The Metallurgical and Materials Engineering graduates are capable to apply knowledge of mathematics, science and engineering.
- (2) The Metallurgical and Materials Engineering graduates are capable to design and conduct experiments, as well as to analyze and interpret data.
- (3) The Metallurgical and Materials Engineering graduates are capable to design a system, a component, or a process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability.
- (4) The Metallurgical and Materials Engineering graduates are capable to function on multi-disciplinary teams.

PO, continued

- (5) The Metallurgical and Materials Engineering graduates are capable to identify, formulate and solve engineering problems.
- (6) The Metallurgical and Materials Engineering graduates have the understanding of professional and ethical responsibility.
- (7) The Metallurgical and Materials Engineering graduates are capable to communicate effectively.
- (8) The Metallurgical and Materials Engineering graduates have the broad education necessary to understand the impact of engineering solutions in a global, economic and societal context.

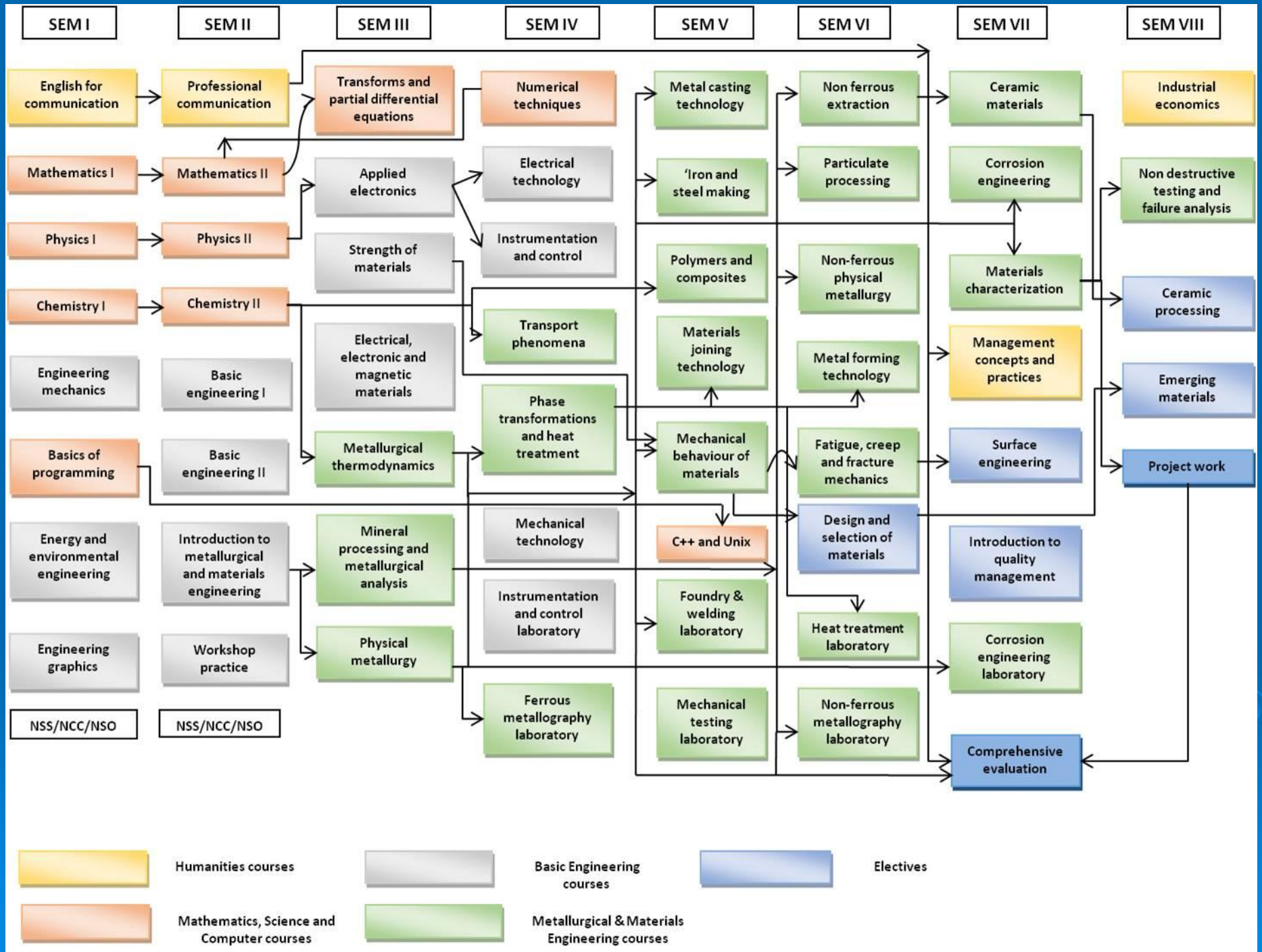
PO, continued

- (9) The Metallurgical and Materials Engineering graduates are capable to engage themselves in life-long learning.
- (10) The Metallurgical and Materials Engineering graduates have knowledge of contemporary /current issues.
- (11) The Metallurgical and Materials Engineering graduates are capable to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (12) The Metallurgical and Materials Engineering graduates are capable to apply fundamental and practical knowledge of unit operations and processes, principles of management and economics for providing better services to Metallurgical and Materials process industries.

CO - Example

- MT303 – Iron & Steel making

  - Classify different kinds of furnaces and their ancillary equipments used for Iron & Steel making
  - Analyze various factors influencing quality of the product in blast furnace during Iron & Steel making
  - Analyze the irregularities and cause of failures in blast furnace and apply the remedial measures for immediate rectification.
  - Compare the traditional steel making to modern day manufacturing routes for the improvement of quality.


SEM I
SEM II
SEM III
SEM IV
SEM V
SEM VI
SEM VII
SEM VIII
English for communication
Professional communication
Transforms and partial differential equations
Numerical techniques
Metal casting technology
Non ferrous extraction
Ceramic materials
Industrial economics
Mathematics I
Mathematics II
Applied electronics
Electrical technology
'Iron and steel making
Particulate processing
Corrosion engineering
Non destructive testing and failure analysis
Physics I
Physics II
Strength of materials
Instrumentation and control
Polymers and composites
Non-ferrous physical metallurgy
Materials characterization
Ceramic processing
Chemistry I
Chemistry II
Transport phenomena
Materials joining technology
Metal forming technology
Management concepts and practices
Emerging materials
Engineering mechanics
Basic engineering I
Electrical, electronic and magnetic materials
Phase transformations and heat treatment
Mechanical behaviour of materials
Fatigue, creep and fracture mechanics
Surface engineering
Project work
Basics of programming
Basic engineering II
Metallurgical thermodynamics
Mechanical technology
C++ and Unix
Design and selection of materials
Introduction to quality management
Energy and environmental engineering
Introduction to metallurgical and materials engineering
Mineral processing and metallurgical analysis
Instrumentation and control laboratory
Foundry & welding laboratory
Heat treatment laboratory
Corrosion engineering laboratory
Engineering graphics
Workshop practice
Physical metallurgy
Ferrous metallography laboratory
Mechanical testing laboratory
Non-ferrous metallography laboratory
Comprehensive evaluation
NSS/NCC/NSO
NSS/NCC/NSO
Humanities courses
Basic Engineering courses
Electives
Mathematics, Science and Computer courses
Metallurgical & Materials Engineering courses

Design of Curriculum and Courses

- Process route?
- Steps?
- Contributors?

BoS

- Members?
- External expert members?
- Now: Experts from IISc Bangalore and BHEL Trichy
- Date of recent meeting – March 18, 2014

Trends in Materials Curriculum

- General Engineering
- Metallurgical Engineering
- Metallurgical and Materials Engineering
- MEMS, MSE, ME….

- Similarities? Differences?

Academic Audit

- Peer review
- Input on our academic process, with emphasis on examination
- Syllabus – Question Paper – Answer Sheet
- Some procedural details
- Recent effort: Experts from IISc Bangalore and PSG Tech. Coimbatore
- Some inferences

Feedback

- Student Feedback, just prior to the semester examinations; centralized
- Initiatives made by dept. / teachers
- Survey at the end of coursework
- Exit surveys initiated, w.r.t. time of graduation

Student Placement?

- Where have the MME graduates of NIT Trichy gone in recent years?
  - Top notch engineering companies: Tata Steel, Tata Motors, GE, Larsen & Toubro, Sundaram Fasteners, Essar Steel, Carborundum Universal
  - Defence Res & Development, MIDHANI, Brahmos
  - IT sector (small numbers): Infosys, TCS, CTS, Wipro
  - Higher studies in India: IIT's, IISc, IIM's
  - Higher Studies overseas: Carnegie Mellon, Ohio State University, University of Florida, University of Texas – Austin, University of New South Wales

Hand holding and Mentoring of Students

- Initiation into the department
- Coaching for placement, offered by seniors to juniors
- Informal counselling for students with difficulties
- Recent: Counselling, by trained professionals, centralized initiative
- Assistance in planning for higher studies
- Links with young alumni – quite active
- Links with old batches (decades ago) – somewhat active

The Main COURSE

- Accomplishments of BTech (MME) Students & Alumni

- During the programme
- Immediately after graduation
- Young alumni
- Experienced alumni
- Related data provided in the file on Rubrics

Achievements during the programme

- Internships, for example
- Recent years: Internships awarded by agencies / organizations such as IAS, IITs, TIFAC, TRA ERF
- Internships awarded by companies such as Tata Steel, Schlumberger, Reliance
- International opportunities – such as MITACS, NUS

- Participation in conferences and competitions
- Some difficulty in attending NMD (mid – Nov.), the flagship event for META, due to overlapping of end semester examinations

- Scholarships, such as OPJEMS

Industrial Training

- Almost all students – at least one summer spent in core industry
- Examples include TVS Group, BHEL, Tata Steel, SAIL, RINL VSP
- Increasing trend – spending one summer – on project in IITs / IISc / National Laboratories

Student Publications

- Student participation in conferences
- Student publications in Journals
- Recent Examples: Sandeep Awasthi, Joshua Gabriel and Suraj

Roles within the Institute

- Class Representative
- Student President and so on
- Cultural Secretary……
- Co-ordinators for Festember, Pragyan…
- Clubs such as Amrutavarshini
- Co-ordinators for METTLE (MEA)
- Student Chapter of the Ind. Inst. of Metals
- Roles in Hostel hierarchy

Extra-curricular activities

- Sports – esp. inter – collegiate events
- Dance and Music – esp. inter – collegiate events
- Quiz - …..
- Inter departmental competition – ‘NITTFEST’

Immediately after graduation

- Typical: Placement or higher studies
- Embarking on professional career in engineering
- Higher Studies – good number to higher studies in engineering, esp. in the USA (and, recently, some more Western Nations)
- Small number going for higher studies in IITs / IISc
- A smaller number of students – for higher studies in management

- Some changing track after few years of experience

Recent Young Alumni

- NITT – corporate world
- NITT – corporate world – higher studies
- NITT - IIT – corporate world
- NITT – USA – corporate sector in the USA

Experienced alumni – indicative profiles

- NITT – corporate career in India
- NITT – corporate career in India – entrepreneurs in India
- NITT – higher studies in the USA – faculty career in IITs
- NITT – higher studies in the USA – corporate career in India
- NITT – higher studies in the USA – corporate career in USA

- 2014 (META) DAA awardee – career in strategic sector in USA

DESSERT

- Activities of the Faculty

- Projects
- Research
- Publications
- Contributions to the Society
- Interaction with the outside world

Faculty Projects

- Great deal of funds from MHRD, DST, DRDO
- Recent – good funding from PSUs
- Some projects – funded by the corporate sector
- Projects in nearly all areas of metals and materials – say mining, steel making, metal forming, powder metallurgy, welding, biomaterials
- Typically, META leads in funded projects within NITT

Faculty Research

- Research Areas: Process Metallurgy, Process Modeling, Alloy Development, Foundry Technology, Powder Metallurgy, Nano Materials, Metal Forming, Welding, Corrosion, Failure Analysis, Bio Materials, Quality Management……
- Centres of Excellence also initiated
- Strong links with industry, leading academic Institutions and National Laboratories – indicative examples
- Groups (not individuals) working in some of the cited areas (names of team members….)

Faculty Publications

- Good track record of research publications
- Example: Last one year: 22 papers published in refereed journals, including Surface Engineering, Advanced Materials Research, Met. and Mater. Trans. A, Trans. IIM, Powder Technology

Contributions to the Society

- And Interaction with the outside world
- Some of the projects / research work – having societal significance
- Active participation in professional societies – esp. in Metals and in Welding; faculty as office bearers in the Ind. Inst. of Metals Trichy Chapter
- Delivering lectures in some upcoming engineering colleges
- Conducting programmes to spread the gospel of metals and materials, amongst school students; esp. role in the Prof. Brahm Prakash Quiz on Materials
- Active interface with industry

COFFEE, please

- Recent Initiatives in the dept. of MME
- Procurement Drive
- Working with the industry
- Centres of Excellence

Procurement Drive

- Sustained efforts for upgradation of facilities related to B.Tech MME programme
- Internal target of nearly twenty crore rupees, for MME, over 2012 – 2015, esp. using Plan Funds
- Additional numbers – as in microscopes and furnaces
- New equipment – as in special casting machinery
- New technical software – as in thermodynamic modeling

Friction Stir Welding – metallurgists working to bring together different materials!

Vac. Induction Melting Furnace

laboratory trials to develop exotic species (materials)

Working with Industry

- META has always been leading in this area
- Even 1990s – project on coatings, for ISRO; project on coal slags with Ministry of Coal
- Recent years – companies such as Tata Steel RINL Vizag Steel Plant, ROOTSCAST, NLC – have sponsored research / research consultancy projects
- Recent queries from – an aircraft company, defence production unit, consumer durables company, steel plants, foundries
- These add ENORMOUS VALUE to the B.Tech MME students – getting a feel for the corporate sector

Centres of Excellence

- CoE – focussed research work, mission oriented, often interdisciplinary in nature

- Two efforts originating in MME:
- CECASE
- Steel Centre

CECASE, excellent, of course

Wish to make **STEEL** for the future

- **Steel Centre**:

The Centre of Excellence in Ferrous Process Metallurgy

- We want to advance certain things many others have forgotten
- STEEL: The Indian scenario?
- STEEL: The Indian academic scenario?

- Utilizing the support of Director, an initiative taken by Dr. Baktha, Dr. Raman, Dr. Anantharaman and Dr. Kumaresh Babu – interesting combination of expertise and experience
- Off to (MoS) New Delhi, next week, with a **WISH LIST**

CONCLUDING REMARKS

- MME: multi – faceted and vibrant
- MME: rel. small class; associated opportunity for close interaction
- MME: excellent funding from the Government and industry
- MME of NIT Trichy is happy to welcome you, for extended interaction over the next two days

- MME: ongoing **Golden Jubilee Lecture series**

- THANK YOU ONE AND ALL