BHARTIA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

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Department of Mechanical Engineering

NEWSLETTER

MAY 2014

IN THIS ISSUE

One Week Training cum Workshop on

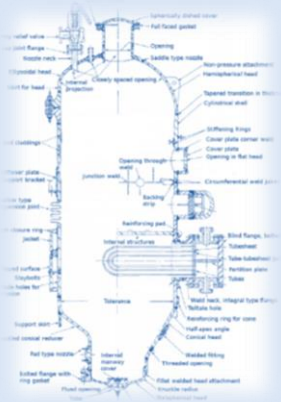
ADVANCED PRESSURE VESSEL DESIGN AND ANALYSIS

Under

Technical Education Quality Improvement Program (TEQIP)

In collaboration with

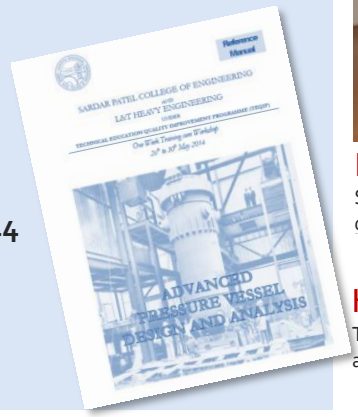
L&T Heavy Engineering



And

ImageGrafix

26th to 30th May 2014



Inauguration of Workshop

An advanced course dedicated to design and analysis of pressure vessel components with emphasis on practical problem solving.

Industry Expert Interaction

Sharing of professional knowledge, case studies and valuable guidance by industry experts.

Hands-on Training

Training sessions followed by hands-on exercises using state-of-the-art design software PV Elite and analysis assignments using ANSYS .

About SPCE

Sardar Patel College of Engineering (SPCE) under the management of the Bhartiya Vidya Bhavan, was founded by Kulapati Dr.K.M.Munshi. It was established to meet the growing demand for engineering talent.

The foundation stone of the college was laid on 17th September 1961 by Shri.Y.B.Chavan (the then Chief Minister of Maharashtra who later became the Defence Minister of India. The college was inaugurated by the first Prime Minister of Independent India, Pandit Jawaharlal Nehru in 1962.The college is dedicated to Sardar Vallabhbhai Patel, an eminent nation builder of independent India.

The college is autonomous and affiliated to the University of Mumbai for the full-time degree and post graduate degree courses. The institute has set high standards for aspiring engineering students and also meets the need of quality education in the challenging world of business. Over the last 50 years the college has gained an excellent reputation in the field of Technical Education.

SPCE is one of the few colleges that have received Grade 'A+' rating for its aided courses from the Govt. of Maharashtra which certifies the spirit of excellence that the institute has symbolized and always practiced.

Our Inspirations

Dr. P. H. Sawant

Professor & Principal - Sardar Patel College of Engineering
Area of Interest - Construction Management, Water resources for surveying.

"It gives me immense pleasure to announce that Department of Mechanical Engineering is organizing one week workshop under TEQIP on Advanced Pressure Vessel Design and Analysis. I am also glad to state that this workshop is a direct outcome of MOU for technical collaboration between SPCE and Larsen and Toubro (L&T). I congratulate the coordinator & Head MED for organizing this type of workshop which will enrich the knowledge of participants in the area of pressure vessel design with valuable practical inputs from industry experts".

Dr.M.M.Murudi

Professor & Vice-Principal - Sardar Patel College of Engineering | TEQIP Coordinator
Area of Interest- Earthquake Engineering.

"As a Vice-principal and TEQIP coordinator I am very happy that Mechanical Engineering Department is taking a leading role by arranging this type of workshop which boosts industry-academia interaction. I congratulate head MED and his team for conducting such important and practical oriented workshop for the benefit of academic fraternity. "

Message from Coordinator

Dr. R. B. Buktar

Department of Mechanical Engineering has organized one week training cum workshop on "Advanced Pressure Vessel Design & Analysis" under TEQIP from 26-05-2014 to 30-05-2014 in collaboration with L&T, Heavy Engineering Division.

This workshop is a part of collaborative activity with Larsen & Toubro (L&T) Company under MOU signed between SPCE and L&T. This is the first type of unique workshop conducted in association with premier industrial organization like L&T. The workshop has aimed to impart practical knowledge of Pressure Equipment Design using theoretical procedures along with PVELITE & other analysis software to participants from engineering colleges & industries.

This workshop has covered theory lectures in the first half & hands on training in the second half. In this workshop experts in the area of pressure vessel design from L&T have shared their knowledge along with some case studies.

PVELITE is a internationally recognized customized software tool widely used by the industries to engineer & analyze a variety of pressure equipment. The rich content of inputs from industry has helped the participants to upgrade their knowledge & skills in the field of pressure vessel design.

Department of Mechanical Engineering has recognized this important topic which is highly important from the perspective of process and petrochemical industry. Industry demands skilled graduate engineers in this field & hence MED wants to empower faculty / industry personnel / students in this area.

Corporate Partner

L&T Heavy Engineering

A brand of Larsen & Toubro Limited

L&T Heavy Engineering has established a reputation in global markets for quality products. It manufactures and supplies custom designed and engineered critical equipment and systems to the needs of core-sector industries and the defense sector. Globally, it is the preferred supplier of equipment for a select range of products.

L&T Heavy Engineering has state-of-the art manufacturing facilities, which are capable of meeting the challenges of technology, quality conformance and delivery, while ensuring cost competitiveness.

These manufacturing plants are among the top fabrication facilities in the world, with processes streamlined to achieve high efficiency and benchmarked to the latest technologies.

Training Partner

ImageGrafix Engineering Services Pvt. Ltd.

ImageGrafix Engineering Services Pvt. Ltd., Mumbai, has conducted hands-on sessions during the workshop using design software PV-Elite by Intergraph, USA. PV-Elite is a complete solution for vessel and heat exchanger design, analysis and evaluation. PV-Elite performs calculations in accordance with ASME Section VIII Divisions 1 & 2, PD 5500 and EN 13445.

Institute and Industry Speakers

S. Ravishankar, *Joint General Manager – Design Competency Center*, **L&T Heavy Engineering**

Graduated in Mechanical Engineering from Govt. College of Engg, Karad in 1988. Recruited by L&T through campus interview. 25 years experience in Process Plant Equipment in various functions such as Design & Engineering, manufacturing & project management in L&T. Also handled trouble shooting of equipment related operational issues reported by end users. Currently heading the Design Competency Center for fertiliser & Petrochemical equipment business. Associated with VJTI, Mumbai for conducting an M.Tech Course on Pressure Vessel Design from 2012 to 2014 as part of an MOU between VJTI and L&T.

Amit Karambelkar, *Deputy General Manager – Design & Engineering*, **L&T Heavy Engineering**

Graduated in Mechcnical Engineering from Walchand College of Engineering, Sangli in 1996. Joined L&T as Graduate Engineer Trainee in 1996. Worked in Design Department for Power Plant Equipment and Heat Exchanger group. Involved in In-house software development for mechanical design of heat exchanger as per ASME code. Involved in 3D automation of manufacturing drawings using Knowledge Based Engineering for Key products like Screw Plug Exchanger, Urea Stripper, Carbamate Condenser, Waste Heat Boiler etc. Overall 17 years of experience in the field of design of Process Plant Equipment.

Sachin Khanderajuri, *Manager – Design & Engineering*, **L&T Heavy Engineering**

Graduated in Mechanical Engineering from Gogte Institute of Technology, Belgaum in 2003. Had brief stints in Master Fire Engineers Pune as Design Engineer and with DRDO as Junior Research Fellow involved in design and analysis of warhead for sub-sonic cruise missile from 2003 to 2006. Associated with L&T from Sep 2006 till date in Finite Element Analysis of Pressure Vessel & Heat exchanger components, sub-assemblies and complete equipment as well wherever required. Currently heading the FEA group in the Design Competency Center.

Fauzan Badiwale, Technical Manager, **IMAGEGRAFIX, Mumbai**

Graduated in Mechanical Engineering from Rizvi College in 2010. Done post graduation from MIT college in Piping Design & Engineering in 2011. Having 2 years of experience in the software field. He has strong working knowledge of softwares such as PV Elite for Pressure Vessels & Heat Exchangers Design, Caesar-II for Pipe Stress Analysis and NozzlePro for doing FEA analysis of nozzles. He has given corporate training to companies such as L&T, Atlas Copco, EagleBurgmann, INDUS Projects, Ingersoll Rand India, Consolidate Chemequip, IOCL, TUV SUD South Asia. He is also providing complete technical as well as troubleshooting issues to all the Western and Northern region.

Nilesh Raykar, *Associate Professor (ad hoc), Mech. Engg. Dept.*, **SPCE, Mumbai**

Completed his Ph.D. from IIT Bombay in 2013, M.Tech. from IIT Bombay in 1990 and graduated in Mechanical Engineering from VJTI in 1988. He worked in the design and special analysis group catering to high pressure vessels and boilers in Heavy Engineering Division of Larsen and Toubro from 1990 to 2009. He has rich experience of engineering different types of critical process equipment and performing their design by analysis. His research interests include modelling of environmentally assisted cracking, fracture mechanics and process equipment design.

Inaugural Function

Distinguished alumnus of SPCE and member of senior management team of Larsen & Toubro (L&T), Mr. G.K. Sadekar, Vice President – L&T-Heavy Engineering, was invited as Guest of Honor for the inauguration function of the workshop. The function was graced by the presence of Dr. P.H. Sawant, Principal, SPCE and Dr. M.M. Murudi, Vice Principal, SPCE.

"This workshop is a fine example of collaborative activity with industry, under MOU signed between SPCE and L&T", Dr. P.H.Sawant said while praising Mechanical Engineering Department for their initiative to organize this event jointly with L&T.

"Pressure vessel design has been a core competency area for Heavy Engineering group of L&T for more than thirty years. I am happy that the subject is getting a thorough and detailed focus from academia", Mr. G.K. Sadekar said with reference to the idea of jointly designed training program on the subject with faculty from SPCE and L&T.

The concept of this program with an active participation from industry was commended by Dr. M.M. Murudi, Vice Principal, SPCE. As a TEQIP coordinator he expressed satisfaction for bringing in expert knowledge of working professionals into a training program.

Principal Dr. P. H. Sawant being felicitated by Mr Ashishkumar Vazir

Mr. G. K. Sadekar, Vice President, L&T, being felicitated by Dr. R.S.Maurya.

Dr. M. M. Murudi, Vice Principal and TEQIP coordinator, lighting the lamp during inauguration ceremony.

Principal Dr. P. H. Sawant and Mr.Gajanan Sadekar, Vice-President, L&T, releasing the Training Manual.

Principal Dr. P. H. Sawant addressing the participants.

Mr. G. K. Sadekar, Vice President, L&T, addressing the participants.

Dr. P.P.Nagrale, HOD-Civil Engineering, being felicitated by Mr. Vyanktesh Wakharkar.

Prof. V.P.Joshi, HOD-Electrical Engineering, being felicitated by Prof. Sachin Vankar.

Dr.S.B.Rane from extreme right, Prof. V.P. Joshi Madam Head Electrical Engg. Dept. from extreme left, Lt. Shyamlee Solanki Madam Controller of Examination, along with the participants.

Introducing Basic Concepts

The introductory sessions begun with a pre-training test. It was followed by self-introduction by participants to the group.

Mr. S. Ravishankar, Joint General Manager, L&T, lucidly explained the basic concepts of pressure vessel design. The broad spectrum of pressure vessel types catering to different process/industry needs was illustrated with ample examples.

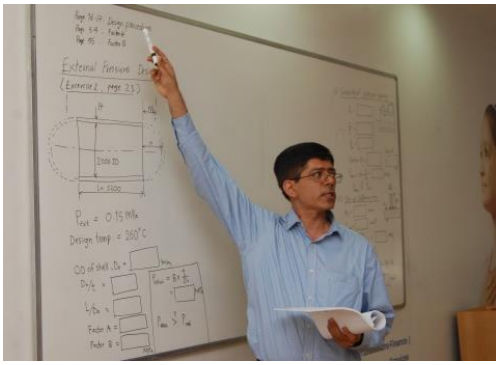
Mr. S. Ravishankar, L&T, introducing the basic concepts.

The design of a number of pressure components for internal and external pressure was covered by Dr. Raykar with illustrative problems solved in the classroom.

Participants giving pre-training test.

The variety of load types, service conditions, criteria for selection of materials/ fabrication process/ non-destructive testing (NDT) were discussed with examples taken from actual practice.

Participants introducing themselves to the group.



Dr. Raykar during hands-on problem solving session.

Exploring the Subject

Mr. Khanderajuri, L&T, discussing nozzle design.

Mr Sachin Khanderajuri, L&T, took the participants through the important topic of nozzle opening design. The need of reinforcement was explained with a variety of examples.

Two approaches to the opening design, that is, area replacement method and pressure-area method, were discussed. The former approach was elaborately covered.

Training session in progress.

Some important design concepts such as reinforcement limits, restriction on design rules and correction factors were explained.

Towards the end of module, adoption of these methods for closely spaced multiple openings was examined.

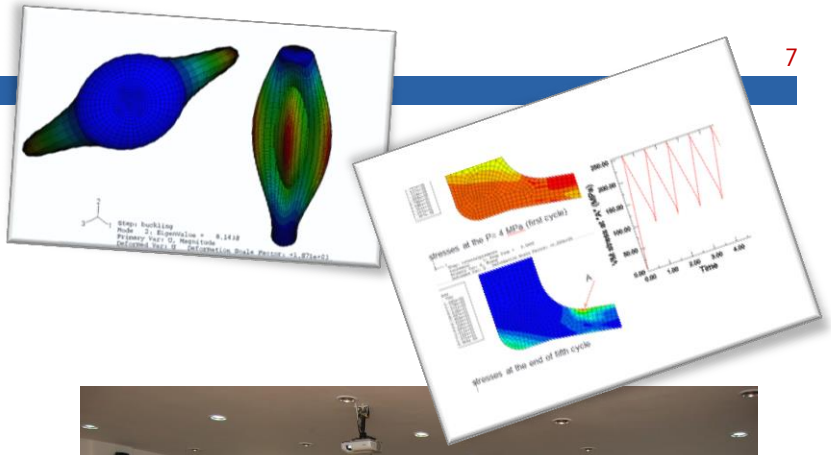
In the later part of session, an interactive exercise on reading of a pressure vessel

Participants studying a manufacturing drawing of pressure vessel.

data-sheet for a real-life project was taken up. Dr. Raykar who conducted this module introduced the participants to the different parts of datasheet and significance of parameters shown therein.

The participants had an opportunity to study the full size production drawings for an actual pressure vessel, courtesy L&T design office.

Venturing Complexities



The pressure vessel components in today's process plants often need use of advanced techniques to establish their design. The modules towards the final days of the workshop were geared to impart training in such advanced topics.

Mr. Amit Karambelkar, L&T, explained the design of bolted flanges which is a complex subject involving numerous design parameters. The methodology to achieve a leak-tight flange joint involves knowledge of gasket selection, calculation of bolt configuration and determination of flange stresses. These were discussed in detail.

Mr. Amit Karambelkar elaborating bolted flange design.

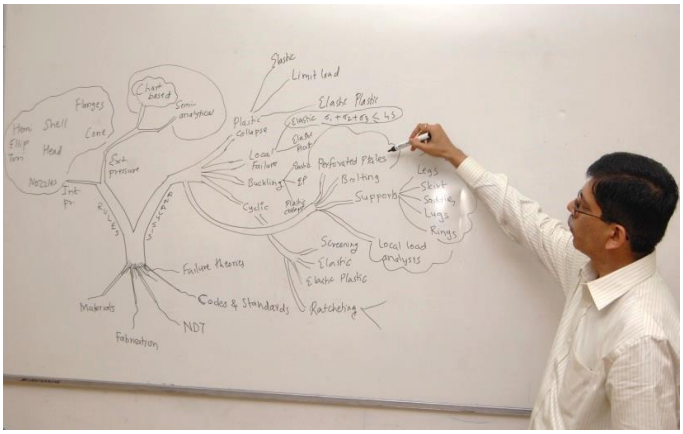
The elastic analysis of pressure vessel components is a widely used procedure for design of critical parts. Mr. Sachin Khanderajuri, L&T, covered this topic with elaboration of important concepts such as stress categorization and stress linearization.

The development of various stress analysis methods over past decades was presented by Dr. Raykar. Alternative methods to elastic analysis, that is, limit load analysis and elastic-plastic analysis were explained along with a solved example for each of the method. A comparison of three methods for a specific case was discussed. Finally buckling analysis procedure was illustrated along with an example of a vertical vessel subjected to external pressure.

Fatigue analysis of pressure vessels is a bit involved subject due to somewhat indeterminate nature of its influencing parameters. The session conducted by Dr. Raykar presented an overview of different methods available for fatigue analysis. The method of elastic fatigue analysis was explained in detail.

The design of supports and vessel attachments need special attention due to the multiple types of loads acting on them. . Participants were introduced to the essential features of wind and seismic loads, different types of supports and methods used for evaluation of stresses around vessel attachments.. A summary of important international standards for wind/seismic calculations was presented. Local load analysis using WRC107 standard was introduced.

Participants focused on a lecture dealing with design of critical components.



Dr. Raykar exploring various analysis techniques using a mind-map tree.

Feedback from the participants

- *"Well organized, systematically arranged program. Keep it up"* (Ms. Ramita Pandey, V.B.Vartak Polytechnic, Vasai)
- *"The lectures and practical sessions were conducted in a very good fashion. Overall, I feel very good to be here for this workshop"* (Mr. G.D. Jambhrunkar, SGGSIE, Nanded).
- *"PV Elite and ANSYS software hands-on training is excellent"* (Mr. Akshay Kulkarni, SGGSIE, Nanded).
- *"Try to increase number of student participants for getting more satisfaction and giving such a amazing concept knowledge"* (Mr.S.S. Rathore, SGGSIE, Nanded).

Gaining Practical Insight

Every designer of pressure vessels must be aware of possibilities of failure, causes of failure and their analysis. This important topic was presented in detail by Mr. G.K. Sadekar, VP, L&T and Mr. S. Ravishakar, JGM, L&T. The importance of data collection, investigation methods and drawing of conclusion was illustrated with two case studies. The nature of reliability curve in the lifecycle of pressure equipment and its use in failure study was explained with the help of the bathtub curve.

The final module was conducted by Dr. Raykar where he discussed various checkpoints and tips for performing analysis of pressure vessels with speed and accuracy. Different topics related to geometric modelling, finite element meshing, boundary conditions and post-processing were discussed.

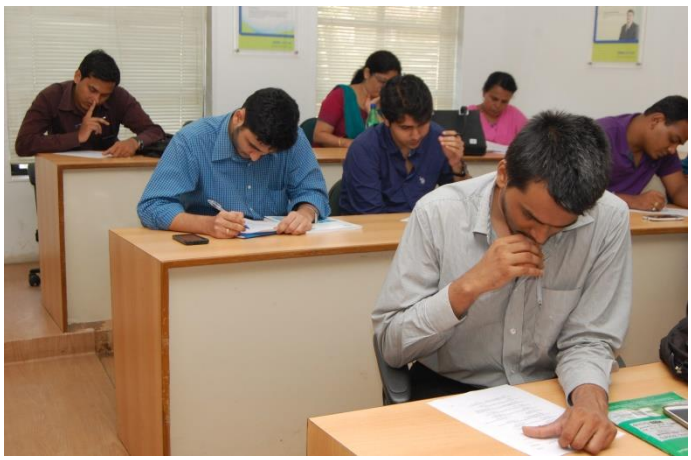
The training was concluded by a post-training test.

Participants during a lecture session.

Mr. S. Ravishankar and Mr. G. K. Sadekar, L&T, taking the participants through a failure analysis case study.

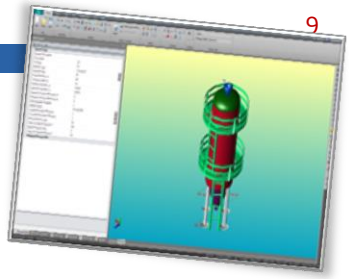
Feedback from the participants

- *"I did not know anything about the software (for pressure vessel design). Now I think I can do something with it"* (Dr. S.S. Naik, BATU, Lonere).
- *"Faculties of SPCE and industrial experts from L&T have done their best. This course is very helpful to us"* (Mr. Vyankatesh Wakharkar, SPCE, ME student)
- *"Efforts for making the training manual are really appreciated"* (Mr. Yatin Sejalia, New Horizons Engineering Services, Mumbai).
- *"Thanks for providing such platform for knowledge sharing"* (Mr. Sachin Chede, Sandip Inst. Of Engg. and Mgmt, Nashik).



Participants giving post-training test.

Hands-on Training: PV Elite, ANSYS



During the workshop, each day's afternoon sessions were devoted to practical learning using either software tools or hands calculation based exercises.

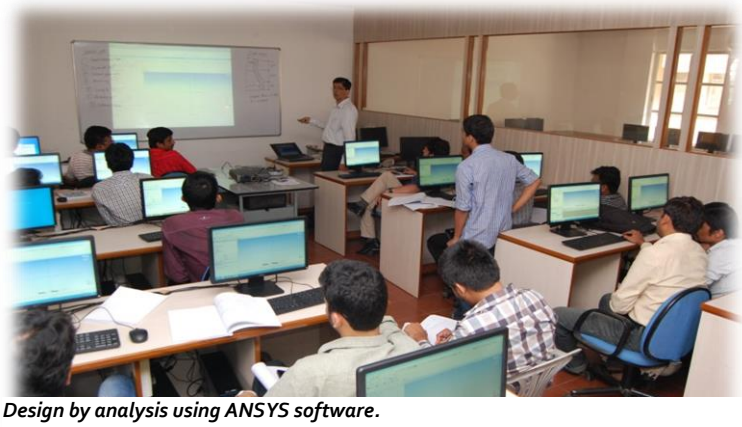
The sessions pertaining to pressure vessel design using PV Elite software were highly interactive and were ably conducted by Mr. Fauzan Badiwale from Imagegrafix, Mumbai. All the components designed earlier by the participants using hand calculations were modelled with PV elite. The group enthusiastically took the challenge of learning the software speedily and verified their manual calculations with reports generated by PV Elite.

The participants were handed over a real-life pressure vessel datasheet. Mr. Fauzan assisted them to build complete model for the pressure vessel specified in the datasheet including shell, head, nozzles, support legs, etc. Most of the participants could finish the task well before the time.

Mr. Fauzan Badiwale, ImageGrafix conducting PV Elite training

On the fourth day, the participants enthusiastically gathered in practical room to do their first stress analysis for a pressure vessel component. Dr. Raykar introduced the participants about steps involved in elastic analysis of a shell to cone junction using ANSYS software. This was followed by instructions to develop the finite element model starting with material definition, geometry preparation, mesh generation and evaluation of results using stress linearization.

Participants concentrating on exercises during hands-on session.



Design by analysis using ANSYS software.

Valedictory Function

Chief guest Dr. G. T. Thampi, Principal, TSEC, addressing the participants.

Dr. R. B. Buktar addressing the participants.

Dr. M. M. Murudi handing over certificate to Dr. Sachin Naik.

Prize Winners of Post-Training Test

Mr. Yatin Sejaliya, Mr. Deepak Patil and Mr. G. D. Jambhrunkar, securing the highest marks during post-training test, receiving prize from Dr. G. T. Thampi.

VOTE OF THANKS

I thank our Principal Dr. P.H.Sawant and Vice-Principal Dr. M.M. Murudi for encouraging and motivating Mechanical Engineering Department to conduct this workshop.

I take this opportunity to thank Dr. G.T. Thampi for squeezing out his valuable time from busy schedule & grace this occasion with his timely presence.

I take this opportunity to thank Mr. G. K. Sadekar and our eminent speakers from L&T who shared their knowledge & helped in promoting industry-institute interaction.

I thank coordinator Dr. R.B. Buktar and co-coordinator Dr. N. R. Raykar for planning and organizing this workshop.

I thank Mr. Fauzan Badiwale , ImageGrafix, for smoothly conducting the practical sessions using PV Elite software.

At the end I also thank all the participants for sincerely attending all the theory and practical sessions conducted during the workshop.

Last but not the least I thank our supporting staff Mr.Luis Dias, Mr. Kolapate and event coordinators Mr.Baste and Mr. Potdar for smooth conduct of this workshop.

Dr. S. B. Rane delivering the Vote of Thanks.

Together with the Group …

List of Participants

1. Mr. Sachin Chede, Sandip Inst. of engg. & Mgmt. Nashik
2. Mr. Durgesh Dandekar, SKN Sinhgad Inst. of Tech. , Pune
3. Mr. Deepak Patil, S.P.C.E. Andheri
4. Mr. Ashishkumar Vajir, S.P.C.E. Andheri
5. Mr. Vyankatesh Wakharkar,S.P.C.E. Andheri
6. Mr. Sujit Chankhore, S.P.C.E. Andheri
7. Mr. Jayesh Vaghela, S.P.C.E. Andheri
8. Mr. Atul S.Sonawane, S.P.C.E. Andheri
9. Mr. Snehankush Chikode, S.P.C.E. Andheri
10. Mr. Bharatbhushan Kale. Datta Meghe COE.,Airoli
11. Mr. Chandan Chaudhari, Datta Meghe COE, Airoli
12. Mr. Yatin Sejaliya, New Horizons Engg. services, Mumbai
13. Mr. FalgunV.Mewada, SVNIT, Surat
14. Dr. Sachin Naik, BATU, Lonere
15. Dr. Hemantkumar Warhatkar, BATU, Lonere
16. Mr. S. V. Eklarkar, SGGSIE, Nanded
17. Mr. Prashanth Machkale, SGGSIE, Nanded
18. Mr. G. D. Jambhrunkar, SGGSIE, Nanded
19. Mr. D. T. Mehata, SGGSIE, Nanded
20. Mr. Akshay Kulkarni, SGGSIE, Nanded
21. Mr. Sumitkumar Rathore, SGGSIE, Nanded
22. Ms. Ramita Pandey, V. B. Vartak, Vasai
23. Ms. Sangeeta Kasbe, V. B. Vartak, Vasai

Topics suggested by the participants for future training programs

- *Design of heat exchangers, manufacturing of pressure vessels (Mr. S. S. Rathore, SGGSIE, Nanded)*
- *Failure analysis (Mr. Sachin Chede, Sandip Inst. of engg. & Mgmt. Nashik)*
- *Course related to automobile engineering like, engine design, aerodynamics, vehicle dynamics (Mr. G. D. Jambhrunkar, SGGSIE, Nanded)*
- *Training in sheet metal forming, particularly in complex parts, mechanics of metal forming (Mr. S. V. Eklarkar, SGGSIE, Nanded)*
- *Advanced finite element analysis (Mr.Ashish Vazir, M.E. student, SPCE).*

Sweet Memories

Mr. Baste, Mr. Potdar and Mr. Luis at the registration desk.

Dr. P. H. Sawant and Mr. G. K. Sadekar sharing a ligher moment.

Paying close attention to a point.

Participants interacting during a practical session.

Discussions over the lunch.

Participants enjoying lunch during the day.