

BIO-DATA OF Prof.P.R.BHANU MURTHY

1. **Name of Staff** : Dr. P. R. Bhanu Murthy
2. **Date of Birth** : 06/06/1962
3. **Nationality** : **Indian**

4. **Educational Qualifications:**

- B.Tech. (Civil Engineering), Sri Venkateswara University, Tirupati (1983).
First Class with Distinction
- M.Tech. (Transportation Engineering), Regional Engineering College, Warangal (1987).
First Class with Distinction (University Topper)
- Ph.D. (Transportation Engineering), JNT University, Hyderabad(2000).

5. **Membership of Professional Societies** :

- Fellow, Institution of Engineers, Kolkata.
- Life Member, Indian Roads Congress, New Delhi.
- Life Member, Indian Society for Technical Education, New Delhi.
- Life Member, Institute of Urban Transport, New Delhi.

6. **Research Publications** : **International Journals** 9
National Journals..... 5
**International Workshops/
Conferences**..... 13
National Conferences/Seminars ... 17

7. **Employment Record** : **Professor of Civil Engineering (2006 Till date)**
JNTUA, Anantapur.

Associate Professor (1999 – 2006)

Centre for Transportation Engineering
Jawaharlal Nehru Technological University
Hyderabad.

Assistant Professor (1989 – 1999)

Centre for Transportation Engineering
Jawaharlal Nehru Technological University
Hyderabad.

8. **Details of Experience:**

8.1. Academic Experience:

1. 33 years of Teaching Experience at Post Graduate and Graduate Level.
2. Worked as Chairman, UG Board of Studies in Civil Engineering, JNTUA
3. Acted as Examiner for NIT Calicut, NIT Warangal, S.V.University, S.K.University, Andhra University, Kakatiya University, Nagarjuna University ,GITAM University and Osmania University.
4. Authored B.Tech. course material for the subject of Transportation Planning and Design for JNT University.
5. Member of Academic Boards of JNT University Hyderabad, Hyderabad; SK University, Anantapur; G.Pulla Reddy College of Engineering, Kurnool and Engineering Staff College of India, Hyderabad.

8.2. Research Experience:

- **Visited Germany as Senior Research Fellow under DAAD Fellowship Program** for three months during August 20th to November 17th,2009 Sponsored by Federal Government of Germany under German Academic Exchange Program to work on Indo-German Project on Hyderabad Megacity
- Obtained Doctoral Degree in Transportation Engineering for the research work carried out on the **Operational Analysis of Signalized Urban Intersections under Mixed Traffic Conditions.**
- Published and Presented 44 Technical Papers in various Conferences and Workshops (International Journals-9, National Journal –5, International Conferences-9, International Workshops-4, National Conferences – 12, National Seminars – 5).
- Supervised more than 100 M.Tech Dissertation Projects in the areas of Traffic Engineering and Transportation Planning.
- Successfully guided Two Ph.D. works and Presently Guiding three Doctoral Projects in Transportation Engineering.
- Project Coordinator, MHRD Sponsored Research Project, **Critical Evaluation of Pavements of Hyderabad City,1992-1995 (Rs.8.0 lakhs)**
- One of the Investigators for the R-13 Project of Ministry of Surface Transport, Government of India on Study of Road Intersections under Mixed Traffic Conditions (1987).

8.3. Consultancy Experience:

1. **Project Coordinator, Comprehensive Traffic Management Study for Cyberabad Area,** Sponsored by the Cyberabad Traffic Police, Government of Andhra Pradesh.(**Rs.11.25 Lakhs**)
2. **Project Coordinator, Upgradation of KSRTC Bus Terminals in Karnataka,** Sponsored by the Karnataka State Road Transport Corporation, Government of Karnataka. (**Rs.11.00 Lakhs**)
3. **Project Coordinator, Development of Junction Improvement Plans in MCH Area,** Sponsored by Municipal Corporation of Hyderabad, Government of Andhra Pradesh. (**Rs.6.00 Lakhs**)
4. **Project Coordinator, Comprehensive Parking Plan Development for Hyderabad Begumpet Airport,** Sponsored by Airports Authority of India (AAI), Government of India.(**Rs.0.75 Lakhs**).
5. **Project Coordinator, Feasibility Study for Pedestrian Foot Over bridge at Abids,** Sponsored by Municipal Corporation of Hyderabad, Government of Andhra Pradesh. (**Rs.0.30 Lakhs**)
6. Member, JNTU Study Team for **Safety Certification of Ropeway at Srisailam,** work done for AP Tourism Development Corporation (**Rs.2.0Lakhs**)
7. Coordinated the Quality Control of BT Roads in MCH Area during 2000 – 2003 (**Rs. 12.00 Lakhs**)

8.4. Sponsored Projects:

Got a sanction of Rs.16.50 lakhs under MODROBS Scheme of AICTE for Modernization of Highway engineering Lab in 2017 as the Coordinator.

8.5. Administrative Experience:

1. Presently working as **Director, Faculty Development Programs Cell, JNTUA** since May 3rd,2021
2. Worked as **Director, Academic Audit of JNTUA** since December,2018 till 3rd May,2021
3. **Worked as Head, Department of Civil Engineering, JNTUA College of Engineering** from January,2015 to December,2018

4. Worked as **Director of Evaluation of JNTUA** looking after the Examinations of all the affiliated Colleges of JNTUA spread over a jurisdiction of 5 districts of Andhra Pradesh State **from February,2013 to Jan 2015**
5. **Director, Foreign Affairs and Alumni Matters of JNTUA, from September,2012 to February,2013**
6. **Director of Admissions of JNTUA, from March 2011 to September,2012**
7. **Officer on Special Duty (OSD),JNTUA Examination Branch, March 2009 to March 2011**
6. **Professor Coordinator, Incharge of Academic Section, JNTUA College of Engineering, Anantapur from April 2006 to March 2009**

9.0 Refresher Courses and Orientation Courses Attended:

Details of Course	Duration	Place
UGC Sponsored Refresher Course on "Remote Sensing, GPS and GIS"	Three weeks 16 th May to 4 th June, 2005	UGC – Academic Staff College, JNT University, Hyderabad
ISTE sponsored Short Term Training Program on "Geomatics Engineering (Remote Sensing and GIS) in Environmental Management"	Two weeks 15 th March to 27 th March, 2004	Centre for Environment, IST, JNT University, Hyderabad
ISTE Summer School on "Traffic Operation, Control and Management in Urban Centres"	Two weeks 5 th June to 17 th June, 1995	SVRCET (REC), Surat
ISTE Summer School on "Modern Management Techniques for Technological Institutions"	Two weeks 2 nd May to 14 th May, 1994	JNTU College of Engineering, Hyderabad
ISTE Winter School on "Modelling the Urban Bus Transit Network Systems Analysis"	Two weeks 16 th Dec to 29 th Dec,1991	IIT, Madras
ISTE Summer School on "Photogrammetry for Transportation Engineering"	Two weeks 4 th May to 17 th May,1988	Anna University, Guindy, Madras
Advanced Unix, C, C++ and Network Concepts with Programming in TCP/IP	Twenty Two weeks (Part-Time) 15 th March to 30 th August, 1997	University Computer Centre, JNT University, Hyderabad

10.0. Professional Recognition and Distinctions:

- **Member, Technical Advisory Committee(TAC) for Hyderabad Metropolitan Development Authority (HMDA)** to evaluate the proposals for **Comprehensive Transportation Study (CTS) for Hyderabad Metropolitan Area** and to advise during the course of CTS
- **Member, Technical Advisory Committee(TAC) for Capital Region Development Authority of AP (APCRDA)** to evaluate the proposals for **Comprehensive Transportation Study (CTS) for APCRDA** and to advise during the course of CTS
- **Member (Technical) in the High Level committee formed by the Government of AP** as per the Directive of the High Court of Andhra Pradesh **for the Preparation of action Plan for Twin Cities.**
- **Member in the High Level committee formed by the Government of AP for the Preparation of Comprehensive Transportation Strategy for Hyderabad Metropolitan Area** . The Committee is headed by the Secretary, Municipal Administration and Urban Development, GoAP

- **Technical Advisor on Traffic to Government of AP** for its program, **Andhra Pradesh Urban Services for Poor (APUSP)** funded by **DFID,UK**.
- **Member, State Level Technical Committee for Road Safety** formed by the **Government of AP** for the Roads & Buildings department. The Technical Committee is headed by the Deputy Chief Engineer (R & B) and consists of SEs of different Wings of R & B and other Experts. **The Committee is responsible for formulating Standards and Specifications for Road Safety interventions for R & B roads through out the AP State.**
- **Member (Traffic Advisor), District Level Coordination Committee of Ranga Reddy District** headed by the Collector, Ranga Reddy District. The Coordination Committee consists of Joint Collector, Municipal Commissioners of all Municipalities under Ranga Reddy District, District Level Officers of all the Departments like Transco, Revenue, Police, R & B, HMWSSB etc.
- **Invited as an Expert by the Project Director & Special Collector, Outer Ring Road, on behalf of GoAP** to participate in the Work shop on **Outer Ring Road – Greater Hyderabad Growth Corridor** to deliberate and give suggestions. The Workshop was held on 22nd June 2005 at Center for Good Governance, Hyderabad and had eminent Professionals from National Level as Special Invitees and the officials from the State
- **Invited as an Expert to the First International Workshop on Hyderabad as Mega City of Tomorrow** held during 1st to 8th March, 2006, at Hyderabad. The Work shop is **Organised under the aegis of the Federal Ministry of Education and Research, Germany and Professional from the Germany and United states took Part in it apart from the GoAP officials.**
- **Invited by the Additional Commissioner (Traffic & Transportation), MCH on behalf of Andhra Pradesh Urban Finance and Infrastructure Development Corporation Limited, GoAP** to Participate in a Work shop on **Transport and Traffic Sector Plan for Hyderabad City** held on 7th February, 2006 at Administrative Staff College of India, Hyderabad. The workshop is organized to discuss the issue related to **preparation of Traffic and Transportation Plans and Proposals to be submitted to Government of India for funding under Jawaharlal Nehru National Urban Renewal Mission (JNNURM).**
- **Invited to Participate and make a Presentation in a Work Shop on Challenges Faced by APSRTC and Remedies** on 17th, July,2005 at Administrative Staff College of India, Hyderabad. The Work shop is organized on behalf of Government of AP as per the High Court Directive and was attended by the three members ministerial sub–committee formed by GoAP
- **Invited by the Commissioner, MCH to Participate in the First International Work shop on Research for Sustainable Development of the Mega Cities of Tomorrow** held on 12th – 14th, December, 2005 at Hotel Taj Residency, Hyderabad. **The work shop is organized by Hyderabad Municipal Corporation in collaboration with European Institute for Energy Research. The Workshop was attended by a German Consortium of Ten Well Known Institutes and Indian Researchers.**
- **Invited as an Expert to the International Round Table on Sustainable Transportation and Land Use Planning Strategies for the future** held on August 7th, 2003 at Administrative Staff College of India, Hyderabad. **The Round Table is organised under the aegis of the**

USAID/ India Mission and Professional from the Harvard University took part in it apart from the GoAP officials.

- **Technical Advisor on Traffic and Transportation related matters** to Government agencies like **Hyderabad Urban Development Authority, Municipal Corporation of Hyderabad, Hyderabad Traffic Police, Cyberabad Traffic Police and Transport Department**
- **Delivered more than 75 invited lectures** in various organizations like **Central Institute of Road Transport (CIRT), Pune; National Police Academy, Hyderabad; Andhra Pradesh Police Academy, Hyderabad; National Academy of Construction, Hyderabad; and Engineering Staff College of India, Hyderabad.**

AREAS OF EXPERTISE:

- **Traffic Engineering**
- **Transportation System Management**
- **Urban Transportation Planning**
- **Traffic Analysis**
- **Highway Engineering**

PUBLICATIONS OF Prof.P.R.Bhanu Murthy **DETAILS OF TECHNICAL PAPERS PUBLISHED/PRESENTED**

INTERNATIONAL JOURNALS

1. **Accuracy of Traffic Volume and Classification Data Collection at Signalized Urban Intersections**
S. Pradeep Reddy and P.R.Bhanu Murthy
International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
2. **An Analytical and Practically Feasible improvisation over representation of Sky-View-Factor**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
American International Journal of Research in Formal, Applied & Natural Sciences, Vol. 6, Issue 2, March-May, 2014, pp. 147-150.
3. **Influence Of Bangalore’s Canyon Geometry On The Intra-Urban Ambient Air Temperature**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
Scientific Herald of the Voronezh State University of Architecture and Civil Engineering. Construction and Architecture ,Russia, Vol. 23, Issue No. 3, July 2014, pp. 40-50,
4. **Relative Magnitude Analysis (R.M.A.) and its Comparison over other Computational Approaches**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR and Reddy, PSK
International Journal of Mathematical Sciences and Engineering Applications, Vol 6 (1), 2012, pp.381-390.

5. **Comparison studies in Land-cover Mapping Analysis - A Case Study**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
International Journal of Emerging Technologies in Computational and Applied Sciences, Vol. 8, Issue 6, March - May, 2014, pp. 499-503
6. **Distinguishing between Global Warming and Urban Warming for Bangalore with the aid of Statistical Analysis**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
American International Journal of Research in Science, Technology, Engineering & Mathematics, Vol. 6, Issue 1, March-May, 2014, pp. 57-60
7. **Effect of Public Transportation Policies on Environment- A Case Study of Hyderabad Metropolitan Area**
K. Bhava Narayana and Dr. P.R.Bhanu Murthy
Research Journal of Engineering and Technology, Vol I, April-June,2008
8. **Analysis of Traffic Impedance Due to Kerb Side Bus Stop on Traffic Stream Speed**
Ramesh Reddy.R, Dr. P.R.Bhanu Murthy and Dr.Srinivasulu.S
Research Journal of Engineering and Technology, Vol II, October-December ,2009
9. **Effect of Highly Maneuverable Vehicle Group on Saturation Flow Rate at Signalized Urban intersections under Mixed Traffic Conditions**
Dr. P.R.Bhanu Murthy and Sreenivasa Reddy.G
Research Journal of Engineering and Technology, Vol II, October-December ,2009

NATIONAL JOURNALS

1. **Determining Classification and Standard Dimension of Vehicles for Calculating Saturation Flow for Signalized Urban Intersections**
S. Pradeep Reddy and P.R.Bhanu Murthy
Journal of Architecture and Civil Engineering Volume 6 ~ Issue 5 (2021) pp: 01-11
2. **Vissim as a Simulation Tool for Analyzing Over-Saturated Signalized Urban Intersections with Heterogenous Traffic**
S. Pradeep Reddy and P.R.Bhanu Murthy
GORTERIA JOURNAL, VOLUME 34, ISSUE 6 - 2021
3. **Township Guidelines to Curb Urban Heat Island Effect**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
Journal of the Indian Institute of Architects, Vol. 80, Issue 12, December,2015, pp. 47-49.
4. **Simulation Of An Uncontrolled Urban Intersection With Pedestrian Crossings**
Prof . S. Ragahvachari, K.M. Badri Nath and P.R. Bhanu Murthy
Indian Roads Congress Highway Research Bulletin No. 48, 1993.
5. **Quantification of Impedance to Traffic Flow at Kerb Side Bus Stops by Artificial Neural Networks**
R. Ramesh Reddy, Dr.P.R.Bhanu Murthy and Dr.S.Srinivasulu
Technology Spectrum, JNTU,Hyderabad Vol.2, March, 2008

INTERNATIONAL CONFERENCES

1. **Influence Of Land-Use Pattern On Temporal Climatic Variations Mapping Bangalore City, India**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
5th International Congress of Environmental Research, Universiti Malaysia, Terengganu, Malaysia, 22-24, November, 2012

2. **Urbanisation of Bangalore & Its Impact On Water-Bodies**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
11th Asian Urbanization Conference,Osmania University,Hyderabad,December, 10-13,2011
3. **Issues and Problems of Traffic Management and Control in a Multimodal Environment – A Case Study of Hyderabad**
Dr. P.R.Bhanu Murthy
World Conference on Transport Research held in University of California, Berkeley,June 24th – 28th,2007
4. **Human Factors In The Design Of Highways For Improving Road Safety**
Dr. P.R. Bhanu Murthy
International Conference on Disaster Management: Infrastructure and Control Systems, National Academy of Construction, Hyderabad , November, 10-12,2003.
5. **Assessment Of Vehicular Emissions From Enhanced Traffic Growth – A Case Study Of Proposed Project Activities At Buddha Poornima Project Area, Hussain Sagar, Hyderabad**
T.Vijaya Lakshmi, Dr. P.R.Bhanu Murthy and Prof. Y.Anjaneyulu
International Conference on Industrial Pollution and Control Technologies (ICIPACT 2001) , Organised by the Centre for Environment, JNTU, Hyderabad , December, 7 – 10 ,2001.
6. **Simulation Modelling Of Delays And Queues At Signalised Urban Intersection In Mixed Traffic**
P.R.Bhanu Murthy
Fifth International Conference on Computers in Urban Planning and Urban Management (CUPUM 97), Indian Institute of Technology , Mumbai, 1997. Proceedings Published by Narosa Publishing House,1997.
7. **Effective Indicators Of Pedestrian Responses In A Multi-Mode Traffic Environment.**
P.R. Bhanu Murthy, Md. Masood Ahmed Khan and D.Ramesh
International Conference on Traffic Safety, New Delhi, January, 27-30,1991. Proceedings Published by Macmillan India Ltd., 1991.
8. **Flow Speed Density Models For Pedestrian Traffic In Urban Areas**
P.R.Bhanu Murthy
International Conference on Road Safety, Andhra University, July 24-27, 1997.
9. **Occurrence Of Safe Crossing Gaps For Pedestrian Under Varied Traffic Conditions**
P.R.Bhanu Murthy and R.Ramesh Reddy.
International Conference on Road Safety, Andhra University, July 24-27, 1997.

INTERNATIONAL WORKSHOPS

1. **Transportation Planning for Hyderabad Metropolitan Area: Issues and Challenges**
Dr. P.R.Bhanu Murthy
Indo_German Workshop on “Integration of Sustainable Infrastructure in Spatial Urban Planning for Future Megacities in India” held in Karlsruhe,Germany Organised by European Institute for Energy Research and University of Karlsruhe, October, 7- 13, 2006.
2. **Transportation Model for a Sustainable Hyderabad**
Dr. P. R .Bhanu Murthy
Indo_German Workshop on “Hyderabad as a Megacity of Tomorrow: Sustainable Urban Food and Health Security and Environmental Resource Management” held in Hyderabad, India, organized by Humboldt University, Germany during February, 19th-23rd, 2007.

3. **Traffic Education and Training for Road Safety: Issues in the Indian Context**
Dr.P.R.Bhanu Murthy
International Workshop on "Road Safety Education for Developed Countries" Organised by Institute of Road Traffic Education (IRTE) and its Global Partners at India Habitat Centre, New Delhi, January, 11 - 13, 2007.
4. **Improving Public Transport For Better Land Use And Cleaner Environment**
Dr.S.Nagabhushana Rao, S.Padam and Dr. P.R.Bhanu Murthy
International Workshop on "Transportation, Land Use and Environment" in Hyderabad, India, Jointly Organised by Harvard University, Centre for Good Governance, Government of AP and Administrative Staff College of India (ASCI) at Administrative Staff College of India (ASCI), Hyderabad, December, 2 - 4, 2002.

NATIONAL CONFERENCES

1. **Comparison studies in Land-cover Mapping Analysis - A Case Study**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
National Conference on Challenges in Research & Technology in the coming decades, S.D.M. Institute of Technology, Dharmasthala, 27-28, Sept 2013
2. **Global Warming and Wetlands: A Conjoint Analysis for Bangalore**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
8TH All India People's Technology Congress, Science City, Kolkata, February 11-12, 2011
3. **Combating Global Warming impacts at Regional level by mitigating Urban Heat Island effect.**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
8TH All India People's Technology Congress, Science City, Kolkata, February 11-12, 2011
4. **Analysis of Air temperature of Bangalore city as a function of Urban Modification**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
5th Indian Environmental Congress, PAACET, Trivandrum, 22-23, March, 2010
5. **Parametric Study of Heat Island Effect due to Urban Sprawl in Bangalore City**
Gopinath Rajesh; Akella Vijayalakshmi; Bhanumurthy, PR
25th National Convention of Civil Engineers on "Climate Change Abatement", Hyderabad, 22-23, October, 2009
6. **Adoptability of Intelligent Transportation Systems for Indian Urban Traffic Scenario: Issues and Problems**
Dr.P.R.Bhanu Murthy
National Conference on Earthquake and Transportation Engineering(NCETE07), Organised by the Department of Civil Engineering, Sona College of Technology, Salem and The Institution of Engineers (India), Salem, March, 22nd and 23rd, 2007.
7. **Urban Transportation Problems: Issues To Be Answered**
Dr. P.R.Bhanu Murthy
National Conference on Urban Transport and The Environment, Organised by the Department of Civil Engineering, KLES College of Engineering & Technology, Belgaum and The Institution of Engineers (India), Belgaum, June, 5 - 7, 2003.
8. **Speed Trends And Gap Acceptance Behaviour Of Pedestrians**
Dr. P.R.Bhanu Murthy and A.V.Narasimha Rao
National Conference on Neglected and Vulnerable Road User: Pedestrian, Organised by the Institute of Road Traffic Education, New Delhi, Sponsored by Ministry of Road Transport and Highways, Government of India, September, 28, 2001.

9. **Systems Approach To Metropolitan Transportation Planning At Macro And Micro Levels**
P.R. Bhanu Murthy and Md. Masood Ahmed Khan
Fourth National Conference on Systems Dynamics, S.V. University, Tirupati, December 14-16, 1990.
10. **Simulation Of A Signalised Intersection To Study Delay And Queuing Behaviour**
P.R.Bhanu Murthy and K.V. Adityam
Third National Conference on Transportation System Studies(NCOTSS-93), Andhra University, Visakhapatnam, December 11-12, 1993
11. **Gap Acceptance And Delay Analysis Of School Going Child Pedestrian At Uncontrolled Crossings**
P.R.Bhanu Murthy and Rafi Ahmed
Third National Conference on Transportation System Studies(NCOTSS-93), Andhra University, Visakhapatnam, December 11-12, 1993
12. **Headway Distribution And Occurrence Of Gaps In Constrained Mixed Traffic Conditions**
P.R.Bhanu Murthy
National Conference on Trends and Techniques in Transportation, Centre for Transportation Engineering, R.E.C, Warangal, August 23-25, 1997.
Proceedings Published by Allied Publishers Ltd,1997.

NATIONAL SEMINARS

1. **Safety in Urban Transportation**
Dr. P. R. Bhanu Murthy
National Seminar on Urban Governance - Technology Thrust organized by Engineering Staff College of India (ESCI), Hyderabad during 27th - 28th, October,2007.
2. **Road Design And Its Importance In Prevention Of Accidents**
P.R. Bhanu Murthy
National Seminar on Road Accidents, Organised by the Association of Motor Vehicle Inspectors,Andhra Pradesh, Hyderabad, 11th March, 2000.
3. **Environmental Pollution By Road Traffic Systems**
P.R. Bhanu Murthy
National Seminar on New Energy Technologies. Osmania University, December 3-4, 1993.
4. **A Study On Speeds Of Motorised 2/3 Vehicles In Urban Traffic In Relation To Volume Levels.**
P.R.Bhanu Murthy and R.Ramesh Reddy.
National Seminar on Road Transportation: Issues and Strategies, Organised by Thapar Institute of Engineering and Technology, Patiala, October 23-24, 1998
5. **A Study On Saturation Flow At Signalised Urban Intersection Based On Saturated Green Times**
P.R.Bhanu Murthy
National Seminar on Road Transportation: Issues and Strategies, Organised by Thapar Institute of Engineering and Technology, Patiala, October 23-24, 1998