

## **Intelligent Transportation Systems (ITS)**

**PGP (Elective) 2015-16 (Term IV / Slot 8)**

Instructor: Sundaravalli N

15 sessions (0.75) credit

### **Course Overview:**

Intelligent Transportation Systems (ITS) is an overarching macro traffic management system. ITS is seen as an effective way of managing transportation networks with a twin objective of resource productivity and effective response time. It is considered to be the futuristic guiding approach for service providers to ensure exceptionally high quality service to the commuters.

ITS is multidisciplinary, with dominance of technology. The standards related to design, project management, operations and maintenance are evolving. Needless to emphasize, they are complex and challenging. ITS requires a supporting policy environment of the state. Investments required are huge, hence there is a need to articulate a business case. The life cycle of ITS includes conceptualization, design, project management, operations, maintenance and enhancements.

This course attempts to provide an overview of several aspects related to ITS. Students who take this course would be in an advantageous position to undertake professionally demanding, intellectually challenging and financially rewarding career opportunities across the globe.

There are four modules in the course:

1. Introduction to the Course
2. Anatomy of ITS
3. ITS Operations
4. Economics of ITS

### **Course Objectives:**

1. To introduce the concept of ITS as a macro traffic management system.
2. To appreciate the multidisciplinary aspects of ITS.
3. To discuss the enabling role of technology (vehicular technology, infrastructure, information and communication technology).
4. To understand the operational aspects of ITS lifecycle (conceptualization, design, project management, operations and maintenance).

### **Pedagogy:**

A mix of case discussions, lectures and short videos.

### **Evaluation scheme:**

Individual Assignments (2):	40%
Group Project:	40%
Class participation:	20%

**Class size:** Maximum 35 (Open to PGP, PGP-ABM and Exchange students)

## **Module 1: Course Introduction**

### **Session 1: An Overview of ITS**

#### **Reading:**

The Information Superhighway Meets the Highway: Technology and Mobility Trends and Opportunities (HBS / 9-314-093)

### **Session 2: ITS and its Determinants**

**Case:** Travel Time on US-202 South (A) and (B) (W12250 / W12251)

#### **Reading:**

Traffic Congestion Forecasting Based on Possibility Theory, Zhanquan Sun, Zhao Li, Yanling Zhao, Int. J. of Intelligent Transportation Systems Research, pp 1-7, 2014.

## **Module 2: Anatomy of ITS**

### **Session 3: Information and Communications Technology**

#### **Case: Harbour Bridge Tunnels (HKU / 404)**

##### **Reading:**

"The Role of ICT in Driverless, Automated Railway Transportation",  
Sundaravalli N and Shiv Mohan, Intl. J. of Logistics, Systems and  
Management, Vol. 14 (4), pp. 490 - 503, 2013.

### **Session 4: Big Data**

#### **Case: Google Car (HKS / 9-614-022)**

##### **Reading:**

"Traffic Flow Prediction With Big Data: A Deep Learning Approach,"  
Yisheng Lv; Yanjie Duan; Wenwen Kang; Zhengxi Li; Fei-Yue Wang in  
IEEE Transactions on Intelligent Transportation Systems, Vol. 16 (2), pp.  
865-873, 2015, doi: 10.1109/TITS.2014.2345663.

### **Session 5: Communications Systems**

#### **Case: Cracking Oyster (HKS / 743)**

## **Module 3: ITS Operations**

### **Session 6: Capacity Planning**

#### **Case: BRTS (Not registered)**

##### **Reading:**

"Transit signal priority control at signalized intersections: a  
comprehensive review", Y. Lin , X. Yang , N. Zou , M. Franz,  
Transportation Letters, Vol. 7 (3), 2015.

### **Session 7: Project Management**

#### **Case: Oslo Toll Cordon**

**Reference:** “Economic evaluation of intelligent transportation systems strategies: The case of the Oslo toll cordon”, Odeck, J., & Welde, M., IET Intelligent Transport Systems, Vol. 4 (3), pp 221–228. 2010.

### **Session 8: Operations Planning**

**Case:** Delhi - Mumbai Industrial Corridor (HBS / 9-214-077)

#### **Readings:**

“Dynamic road lane management study: A Smart City application”, Chen Wang, Bertrand David, René Chalon, Chuantao Yin, Transportation Research Part E: Logistics and Transportation Review, 2015.

### **Session 9: Fleet Operations**

**Case:** Meru Cabs (ISB-021)

#### **Reading:**

“Effect of Decentralized Congestion Control on Cooperative Systems”, Tatsuaki Osafune , Yuki Horita, Nestor Mariyasagayam, Massimiliano Lenardi, Int. J. of Intelligent Transportation Systems Research, Vol. 13 (3), 2015, pp 192-202.

### **Session 10: Safety and Security**

**Case:** Automating the Paris Subway (HBS / 9-413-061)

#### **Reading:**

“Safety in the Face of Uncertainty: Critical Headway Estimation in Cooperative Adaptive Cruise Control”, Willem van Willigen Leon Kester, Ellen van Nunen, Evert Haasdijk, Int. J. of Intelligent Transportation Systems Research, 2015, Vol. 13 (2), pp 95-106.

## **Module 4: Economics of ITS**

### **Session 11: Strategic Business Planning**

**Case:** Dubai Metro (Not registered)

#### **Reading:**

“Making a Business Case for Intelligent Transport Systems: A Holistic Business Model Framework”, Konstantinos N. Giannoutakis, Feng Li, Transport Reviews, Vol. 32 (6), 2012.

### **Session 12: Revenue Management**

**Case:** Ludhiyana City Bus Services Limited: Pricing for Profits (W14182)

### **Session 13: Operations and Sustainability**

**Case:** Road Pricing or Road Building (HKU / 655)

#### **Reading:**

“Development of an Assessment Tool of the Effects of ITS on CO2 Emissions”, Masao Kuwahara, Ryota Horiguchi, Seiji Hayashi, Shinji Tanaka, Int. J. of Intelligent Transportation Systems Research, 2013, Vol. 11 (3), pp 129-140.

### **Session 14: Investment Policies**

**Case:** Taiwan HSR (HKS / 116)

#### **Reading:**

“Public-Private Partnerships in Transportation Policy: The Case of Advanced Traveler Information Systems”, Wendell C. Lawther, Int. J. of Public Administration, Vol. 28 pp 13-14, 2005

### **Session 15: Emerging Trends in ITS**

**Case:** Mobileye: The future of Driverless Cars (HBS / 9-715-421)

#### **Reading:**

“Setting the stage for autonomous cars: a pilot study of future autonomous driving experiences”, Ingrid Pettersson, I.C. MariAnne Karlsson, IET Intelligent Transport Systems, Vol. 9 (7), 2015, pp. 694 - 701.

#### **Supplementary Readings:**

1. Historical Analysis of the ITS Progress of Japan, Kohei Koide , Takeshi Oishi, Katsushi Ikeuchi, Int. J. of Intelligent Transportation Systems Research, pp 1-10, 2015.
2. "Survey of smartphone-based sensing in vehicles for intelligent transportation system applications", Jarret Engelbrecht; Marthinus Johannes Booysen, Gert-Jan van Rooyen, Frederick Johannes Bruwer IET Intelligent Transport Systems, Vol.9 (10), 2015, pp. 924 - 935.
3. "Bluetooth in Intelligent Transportation Systems: A Survey", M. R. Friesen, R. D. McLeod, Int. J. of Intelligent Transportation Systems Research, 2015, Vol. 13 (3), pp 143-153.
4. "A Methodological Approach for Developing and Assessing Business Models for Flexible Transport Systems", Zografos, Konstantinos, Androutsopoulos, Konstantinos, Sihvola, Teemu, Transportation: Planning, Policy, Research, Practice, Vol.35 (6), pp 777-795, 2008.
5. Gongjun Yan; Weiming Yang; Rawat, D.B.; Olariu, S., "SmartParking: A Secure and Intelligent Parking System," IEEE Magazine in Intelligent Transportation Systems, Vol.3 (1) pp.18-30, 2011.
6. "Profitability Evaluation of Intelligent Transport System Investments", Leviäkangas, Pekka, Jukka Lähesmaa, Journal of Transportation Engineering, 2002.
7. TCRP Report 94, "Fare Policies, Structures and Technologies: Update", 2003

#### **References:**

1. Intelligent Transportation Systems: Smart and Green Infrastructure Design, 2nd Edition, Sumit Ghosh and Tony S. Lee (CRC Press) 2010.
2. Perspectives on Intelligent Transportation Systems, Joseph Sussman (Springer) 2005.

3. <https://www.pcb.its.gov/eprimer.aspx>
4. <http://www.ssatp.org/sites/ssatp/files/publications/Toolkits/ITS%20Toolkit%20content/index.html>
5. Video URL: <https://youtu.be/P32kNI8rr7c>