# ECE4131 : Telecommunication Switching Systems and Networks

Programme: **B.Tech. (ECE)** Year: **3rd/4th** (3rd) Semester :**Summer/I**
Course : Core/Program/Open/HSS/Science/Math : **Program** Credits :**3** Hours : **40**

**Course Context and Overview (100 words):**

This course is designed to provide a detailed treatment of switching principles and control of switching systems, traffic engineering and queuing models, and signalling and transmission protocols for communication networks.

**Prerequisites Courses:**
Principles of Communication

**Course outcomes(COs):**

| **On completion of this course, the students will have the ability to:** |
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| CO1: Should be able to understand transmission, media impairments and various switching hierarchies. |
| CO2 Will be able to evaluate of probability of blocking for various switching networks |
| CO3 Will be able to understand different traffic distribution and Queuing theory fundamentals |
| CO4 Will be able to understand different signalling schemes like SS7 and digital data Network like ISDN |
| CO5 Become familiar with some of the existing and emerging mechanism in high-performance telecommunications networks |

**Course Topics:**

| **Topics** | **Lecture Hours** | |
|---|---|---|
| **UNIT - I**<br>**1. FUNDAMENTALS OF TRANSMISSION, SWITCHING AND SIGNALLING** | **6** | |
| 1.1 Network configurations; Transmission, switching and signalling | 1 | |
| 1.2 Circuit and packet switching; Analog, digital and integrated digital networks. | 1 | |
| 1.3 Transmission media and impairments; 4-wire transmission: Hybrid, echo, stability and crosstalk; | 1 | |
| 1.4 Digital transmission and multiplexing, line coding, framing and bit stuffing, plesiochronous digital hierarchies (PDH) | 2 | |
| 1.5 SONET and SDH: Hierarchical model, frames and justification, virtual tributaries. | 1 | |
| **UNIT - II** | **7** | |

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|---|---|---|
| **2. SPACE AND TIME DIVISION SWITCHING** | | |
| 2.1 Switching elements and switching matrices; Time division time- and space-switching; | 1 | |
| 2.2 Multi-stage switching in Link Systems: General, Two stage networks, three stage networks, four stage networks. | 2 | |
| 2.3 Grades of service of link systems: General, Two stage networks, three stage networks, four stage networks Call packing | 1 | |
| 2.4 Strict sense non blocking networks, internal blocking, distribution and mixing; Evaluation of probability of blocking of switching networks | 2 | |
| 2.5 Lee graph; Call packing, Benes networks and CLOS networks. | 1 | |
| **UNIT - III**<br>**3. TRAFFIC MODELLING** | **10** | |
| 3.1 Traffic characteristics, Erlang, random process and Markov chain modelling of traffic. | 1 | |
| 3.2 Birth-Death models, differential equations and steady-state solutions, | 2 | |
| 3.3 Poisson process; Modelling of arrivals, inter arrival times and service times; Grade of service, time and call congestion | 3 | |
| 3.4 Little's theorem, M/M/1 queue, Erlang-B and Erlang-C formulations, M/G/1 queue, | 3 | |
| 3.5 prioritized queues; Sequential hunting; Loss system with limited sources. | 12 | |
| **UNIT - IV**<br>**4. SIGNALLING SYSTEM STANDARDS** | **11** | |
| 4.1 Subscriber loop signalling; PCM signalling | 1 | |
| 4.2 Channel-associated and common channel signalling | 2 | |
| 4.3 Signalling System No. 7 (SS7): Protocol architecture, signalling units' format, signalling link and network level | 2 | |
| 4.4 Numbering plan and routing; Concept of intelligent networks. | 1 | |
| 4.5 Overview of ISDN, transmission structure, protocol architecture, physical layer, LAPD, basic call control | 2 | |
| 4.6 Overview of ATM, ATM cells, reference model, adaptation layer, cell switching. | 3 | |
| **UNIT-V**<br>**5. MECHANISM IN HIGH-PERFORMANCE TELECOMMUNICATIONS NETWORKS** | **6** | |
| 5.1 Introduction to DSL | 1 | |
| 5.2 Transmission and reception in ADSL | 1 | |
| 5.3 Overview of xDSL. | 1 | |
| 5.4 Overview of VoIP and MPLS | 2 | |
| 5.5 IP Telephony packet based Multimedia Communication | 1 | |

**Textbook/ references (IEEE format):**

**TEXT BOOKS:**

1. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks*"; PHI Publications*

2.Flood, J.E., "Telecommunication Switching, Traffic and Networks", *Pearson Education*. 2001
3. Bertsekas, D. and Gallager, R., "Data Networks", 2nd Ed., *Prentice-Hall of India*.1992
4. Bellamy, J.C., "Digital Telephony", 3rd Ed., *John Wiley & Sons*, 2002
5. Bear, D., "Principles of Telecommunication Traffic Engineering", 3rd Ed., *Peter Peregrinus*. 1988
6. Stallings, W., "ISDN and Broadband ISDN with Frame Relay and ATM", 4th Ed., *Pearson Education.* 2000
7. Black, U., "MPLS and Label Switching Networks", *Pearson Education.*

**REFERENCES:**

1. Olivier, H., Gurle, D. and Petit, J.P, "IP Telephony: Packet Based Multimedia Communications Systems", *Addison-Wesley Longman*. 2000

**Additional Resources:**

Will be notified in due course of time

**Evaluation Methods:**

| Item | Weightage |
|---|---|
| Quiz | 10 |
| Assignment | 20 |
| Class Test | 10 |
| Midterm | 20 |
| Final Examination | 40 |

**Prepared By:**
**Last Update: 28/04/2016**