1. Aims

To make students familiar with some important concepts and techniques on signaling, switching and routing in telecommunication networks.

2. Intended Learning Outcomes

- Identify the fundamental concepts and components about voice over IP, especially the signaling protocol (SIP) and its calling procedure.
- Identify various types of switches and their roles in the telephone network. Apply analytical techniques to compute the cost and blocking probability of various switches.
- Identify various routing schemes and their applications to the real world circuit-switched networks. Apply analytical techniques to compute the blocking probability of various routing schemes.
- Identify the fundamental techniques/concepts of Multi-Protocol Label Switching (MPLS).

3. Syllabus

2.1 The Telephone Network (Chapter 2 of Keshav’s book)
- The big picture
- Routing: routing algorithms, essence of problem, features of telephone network routing
- Transmission: multiplexing, link technologies, analogue to digital conversion, voice coding
- Switching: motivation, space division switching, time division switching
- Signaling: signaling network, switch controller, Signalling System 7 (SS7), state transition diagram

2.2 Voice over Internet Protocol
- Enabling technologies
- Real Time Transport protocol (RTP)
- RTP Control Protocol (RTCP)
- Signaling protocol: Session Initiation Protocol (SIP), SIP’s call establishment procedure

2.3 Circuit Switching (Chapters 5 and 6 of Flood’s book)
- Link systems: concentrator, route switch, expander, multi-stage switching network
- Grades of service of link systems
- Time-division switching, grades of service of time-division switching networks

2.4 Routing in the telephone network (Chapter 7 of Ross’s book, Chapter 11 of Keshav’s book)
- Telephone network topology
- Features of telephone network routing
- Alternate/dynamic routing, Trunk reservation
- Random routing, Least loaded routing, Real world examples: DNHR, RTNR
- Erlang fixed point approximation

2.4 IP routing and label switching in Multi-Protocol Label Switching (MPLS)
- Motivation
- Label switching routers, label switched path
- IP packet forwarding, IP routing, label switching
- Label assignment, label allocation, label distribution
3. **Assessment**

- Continuous assessment
  - Course work: 20% (test and assignment)
  - Laboratory: 20% (a two-third laboratory attendance to be eligible for a pass)
- Examination: 60% (one 2-hour examination)

4. **Tentative Teaching Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>16 January 2009</td>
<td>Course overview + Lab briefing</td>
</tr>
<tr>
<td>2</td>
<td>23 January 2009</td>
<td>Telephone network + Voice over Internet Protocol</td>
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<td>Holiday</td>
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<tr>
<td>3</td>
<td>6 February 2009</td>
<td>Voice over Internet Protocol</td>
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<td>4</td>
<td>13 February 2009</td>
<td>Lab 1</td>
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<td>20 February 2009</td>
<td>Dimensioning a VoIP network + Circuit Switching (CS): Link system</td>
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<td>6</td>
<td>27 February 2009</td>
<td>Lab 2</td>
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<td>7</td>
<td>6 March 2009</td>
<td>CS: Link system</td>
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<td>8</td>
<td>13 March 2009</td>
<td>CS: Grades of service of link systems + Time-division switching networks</td>
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<td>9</td>
<td>20 March 2009</td>
<td>CS: Time-division switching networks</td>
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<td>9</td>
<td>21 March 2009 (Sat.) 9:30am-12:20pm</td>
<td>Lab 3</td>
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<td>10</td>
<td>27 March 2009</td>
<td>Routing in Circuited-Switched Networks</td>
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<td>11</td>
<td>3 April 2009</td>
<td>IP routing and label switching in MPLS</td>
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<td>Holiday</td>
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<tr>
<td>12</td>
<td>17 April 2009</td>
<td>Test + class make up</td>
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<tr>
<td>13</td>
<td>24 April 2009</td>
<td>Lab demonstration</td>
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5. **Booklist**

4.1 **Essential Reading**


4.2 **Supplementary Reading**


Reading assignments will be given out at each lecture. Students are advised to prepare the assigned materials before coming to class.