EE3009: DATA COMMUNICATIONS AND NETWORKING

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Data Communications and Networking

Subject Code
EE - Electrical Engineering

Course Number
3009

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
EE1001 Foundations of Digital Techniques

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil
Part II Course Details

Abstract
The aim of this course is to provide students with an understanding of the basic principles of data communications and IP networking.

Course Intended Learning Outcomes (CILOs)

<table>
<thead>
<tr>
<th>CILOs</th>
<th>Weighting (if app.)</th>
<th>DEC-A1</th>
<th>DEC-A2</th>
<th>DEC-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Describe the architecture of computer networks and explain how internetworking works.</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Explain how information can be represented and sent via communication interfaces and links.</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Explain how reliable data transfer can be achieved in the data link layer.</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Explain the principles and evaluate the performance of medium access control.</td>
<td>x</td>
<td>x</td>
<td></td>
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</tbody>
</table>

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing/constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

<table>
<thead>
<tr>
<th>TLAs</th>
<th>Brief Description</th>
<th>CILO No.</th>
<th>Hours/week (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lecture</td>
<td>Key concepts are described and illustrated. Key concepts are worked out based on problems or software tools.</td>
<td>1, 2, 3, 4</td>
<td>3 hrs/wk</td>
</tr>
<tr>
<td>2 Laboratory</td>
<td>Key concepts are applied to set up networks</td>
<td>1</td>
<td>3 hrs/wk (4 weeks)</td>
</tr>
</tbody>
</table>

Assessment Tasks / Activities (ATs)

<table>
<thead>
<tr>
<th>ATs</th>
<th>CILO No.</th>
<th>Weighting (%)</th>
<th>Remarks (e.g. Parameter for GenAI use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests (min.: 2)</td>
<td>1, 2, 3, 4</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>#Assignments (min.: 3)</td>
<td>1, 2, 3, 4</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Lab Exercises/Reports</td>
<td>1, 2, 3, 4</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Continuous Assessment (%) 50
Examination (%)
50

Examination Duration (Hours)
2

**Additional Information for ATs**

*Remark:*
To pass the course, students are required to achieve at least 30% in course work and 30% in the examination. Also, 75% laboratory attendance rate must be obtained.

# may include homework, tutorial exercise, project/mini-project, presentation

**Assessment Rubrics (AR)**

**Assessment Task**
Examination

**Criterion**
Achievements in CILOs

**Excellent** (A+, A, A-)
High

**Good** (B+, B, B-)
Significant

**Fair** (C+, C, C-)
Moderate

**Marginal** (D)
Basic

**Failure** (F)
Not even reaching marginal levels

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**Assessment Task**
Coursework

**Criterion**
Achievements in CILOs

**Excellent** (A+, A, A-)
High

**Good** (B+, B, B-)
Significant

**Fair** (C+, C, C-)
Moderate

**Marginal** (D)
Basic
Failure (F)
Not even reaching marginal levels

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**Part III Other Information**

**Keyword Syllabus**

**Computer Networks and Internet**
Components of a small network, circuit switching, packet switching, Internet architecture, access networks, ISP, routers, Internet exchange and backbone, performance measures, protocol layering, encapsulation/de-capsulation.

**Data Transmission and Transmission Media**
Digital representation of information, digital and analog transmission, transforming data to signals, transmission modes, multiplexing, asynchronous/synchronous communications, error detection and correction, transmission media: guided and wireless.

**Data Link Layer**
Reliable data transfer and ARQ: stop-and-wait, go-back-N, selective repeat; Data Link Controls: framing, point-to-point protocol, HDLC data link control.

**Medium Access Control**
Random access: ALOHA, slotted ALOHA, CSMA, Collision Detection and Avoidance; Scheduling; Channelization.

**Local Area Networks**
LAN Structure, interconnection using switches; LAN standards: Ethernet, VLAN and Wi-Fi.

**Network Layer: Data Plane**
Network data and control plane; Router: structure and design principles; Internet Protocol: IPv4, addressing, datagram fragmentation, NAT, IPv6; Address resolution; Generalized forwarding and SDN.

**Reading List**

**Compulsory Readings**

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<tr>
<th>Title</th>
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<tbody>
<tr>
<td>Nil</td>
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</tbody>
</table>

**Additional Readings**

<table>
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