<table>
<thead>
<tr>
<th></th>
<th>Name of Course/Module</th>
<th>Data Communications and Networking</th>
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<tbody>
<tr>
<td>2</td>
<td>Course Code</td>
<td>TCE2311</td>
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<tr>
<td>3</td>
<td>Status of Subject</td>
<td>Core for B. Sc Bioinformatics</td>
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<tr>
<td>4</td>
<td>MQF Level/Stage</td>
<td>Bachelor Degree – MQF Level 6</td>
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<tr>
<td>5</td>
<td>Version</td>
<td>June 2012</td>
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<td>6</td>
<td>Requirement for Registration</td>
<td>None</td>
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<tr>
<td>7</td>
<td>Name(s) of academic/teaching staff</td>
<td>Fathin Fakhriah Abdul Aziz, Lew Sook Ling, Lilian Wang Yee Kiaw</td>
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<tr>
<td>8</td>
<td>Semester and Year offered</td>
<td>Trimester 2 (Beta Level)</td>
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<tr>
<td>9</td>
<td>Objective of the course/module in the programme :</td>
<td>To provide students with concepts of data communications and networking. (ii) To understand the fundamentals of Communication Architecture, Protocols and Local Area Networks. (iii) To expose the various types of network in terms of the technologies, hardware, and usage.</td>
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<td>10</td>
<td>Learning Outcomes :</td>
<td>At the completion of the subject, students should be able to:</td>
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<tr>
<td></td>
<td>LO1:</td>
<td>Demonstrate understanding about various data communication transmission media, interface and modulation techniques. (Affective, Level 3)</td>
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<td>LO2:</td>
<td>Understand the link layer data transmission techniques and protocols. (Cognitive, Level 2)</td>
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<td>LO3:</td>
<td>Explain the basic building blocks of a Local Area Network. (Cognitive, Level 2)</td>
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<td>LO4:</td>
<td>Describe the network models, standards, protocols, and concepts of frequency spectrum and bandwidth. (Cognitive, Level 1)</td>
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<td>11</td>
<td>Synopsis:</td>
<td>The course will expose the students to the overall understanding and knowledge in basic data communications and networking. The major area of studies include physical interface, transmission medium, data integrity and security, data compression, improving data communication efficiency, data encoding and modulation, architecture and protocol, LAN, internetworking and digital switching system.</td>
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<td></td>
<td>Kursus ini akan mendedahkan pelajar-pelajar kepada pemahaman keseluruhan dan pengetahuan dalam asas komunikasi data dan rangkaian perhubungan. Topik-topik utama di dalam lingkungan pelajaran termasuk ruang interface fizikal, perantara penghantaran, integriti data dan kawalan, pemampatan data, memperbaiki data kecekapan perhubungan, data encoding dan modulasi, seni bina dan protokol, rangkaian data tempatan, internetworking dan sistem &quot;switch&quot; digital.</td>
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<tr>
<td>12</td>
<td>Mapping of Subject to Programme Outcomes :</td>
<td>Programme Outcomes</td>
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<tr>
<td></td>
<td></td>
<td>PO1: Apply soft skills in work and career related activities</td>
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### PO2: Demonstrate knowledge and understanding of fundamental concepts, principles and best practices

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<thead>
<tr>
<th>Assessment Methods and Types:</th>
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<tbody>
<tr>
<td><strong>Method and Type</strong></td>
</tr>
<tr>
<td>Test</td>
</tr>
<tr>
<td>Quizzes</td>
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<tr>
<td>Final Exam</td>
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### Details of Subject

<table>
<thead>
<tr>
<th>Topics</th>
<th>Mode of Delivery</th>
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| **1. Overview of Data communication Networking Network models**  
Data Communications, Networks, Protocols and Standards, Layered Tasks, Internet Model, Functions of Layers, OSI Model, Layers in the OSI Model, Addressing | 3 2 |
| **2. Data and Signals**  
Analog and Digital Signals, Composite Signals, Frequency Spectrum and Bandwidth, Data Rate Limits (Nyquist Bit Rate, Shannon Capacity), Performance (Throughput, Latency, Propagation Time, Transmission Time, Queuing Time, Bandwidth-Delay Product), Transmission Impairment, More about signals (Throughput, Propagation, Propagation time, Wavelength) | 3 2 |
| **3. Digital Transmission**  
Line Coding (Unipolar Encoding, Polar Encoding (NRZ, RZ, Manchester, Differential Manchester)), Bipolar Encoding (AMI), Other Line Coding Schemes (2B1Q, MLT-3), Block Coding, Sampling (Pulse Amplitude Modulation, Pulse Code Modulation), Transmission Mode (Parallel, Serial (Synchronous, Asynchronous, Isochronous)) | 3 2 |
| **4. Analog Transmission**  
Modulation of Digital Data, Digital to Analog Conversion, Digital to Analog Modulation (Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Amplitude Modulation), Analog to Analog Modulation (Amplitude Modulation, Frequency Modulation, Phase Modulation) | 3 2 |
| **5. Multiplexing And Spreading**  
Multiplexing, Analog Multiplexing (FDM, WDM), Digital Multiplexing (TDM), Spread Spectrum (Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum) | 3 2 |
| **6. Transmission Media**  
Guided (Twisted-Pair Cable, Coaxial Cable, Fibre-Optic Cable), Unguided (Radio Wave, Microwave, Infrared) | 3 2 |
7. **Error Detection and Correction**
   Types of Errors (Single-Bit Errors, Burst Error), Error Detection: Redundancy method (Parity Check, Cyclic Redundancy Check, Checksum), Error Correction: Hamming Code

8. **Data Link Control**
   Flow Control and Error Control, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, HDLC

9. **Multiple Access**
   Multiple Access Protocols, Random Access Method (MA, CSMA, CSMA/CD, CDMA/CA), Controlled-Access Method (Reservation, Polling, Token Passing), Channelization Protocols (FDMA, TDMA, CDMA), Point-to-Point Protocol (PPP), Link Control Protocol, PAP, CHAP, NCP

10. **Wired LANs**
    Ethernet, Traditional Ethernet, Bridged Ethernet, Switched Ethernet, Full-Duplex Ethernet, Fast Ethernet, Gigabit Ethernet

11. **Wireless LANs**
    IEEE 802.11, Bluetooth

12. **Connecting LANs**
    Connecting Devices (Repeaters, Hubs, Bridges, Transparent Bridges (Spanning Tree)), Dynamic Algorithm, Source Routing Bridges, Backbone Networks (Bus Backbones, Star Backbone, Star Backbone), Connecting Remote LANs, Virtual LANs

13. **Virtual Circuit Networks: Frame Relay and ATM**
    Virtual Circuit Switching, Permanent Virtual Circuit, Switched Virtual Circuit, Frame Relay, Asynchronous Transfer Mode

Total

15. Laboratory

16. **Total Student Learning Time (SLT)**
    | Component                  | Face to Face (Hour) | Total Guided and Independent Learning |
    |---------------------------|--------------------|--------------------------------------|
    | Lecture                   | 39                 | 39                                   |
    | Tutorials                 | 26                 | 26                                   |
    | Laboratory/Practical      |                    |                                      |
    | Presentation              |                    |                                      |
    | Assignment                |                    |                                      |
    | Mid Term Test             | 2                  | 10                                   |
    | Final Exam                | 2                  | 20                                   |
    | Quizzes                   | 2 times            | 2                                    |
    | Sub Total                 | 69                 | 97                                   |
    | Total SLT                 | 166/40 = 4.15 => 4 |                                      |

17. **Credit Value**
   4
18. **Reading Materials:**

<table>
<thead>
<tr>
<th>Textbook</th>
<th>Reference Materials</th>
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19. **Appendix (to be compiled when submitting the complete syllabus for the programme):**

1. Mission and Vision of the University and Faculty
2. Mapping of Programme Objectives to Vision and Mission of Faculty and University
3. Mapping of Programme Outcome to Programme Objectives
4. Programme Objective and Outcomes (Measurement and Descriptions)