**Module Code**  
EEU33C02

**Module Name**  
DIGITAL CIRCUITS

**ECTS Weighting**  
5 ECTS

**Semester taught**  
Semester 1

**Module Coordinator/s**  
Dr. Martin J. Burke

### Module Learning Outcomes

On successful completion of this module, students should be able to:

1. Explain the operation of the bipolar junction and MOS Field Effect Transistors and associated logic gates.
2. Analyse simple transistor switching circuits to determine their performance criteria and limitations.
3. Analyse simple transistor switching circuits to determine static and dynamic performance parameters and related operating figures of merit.
4. Explain the operation and evaluate the performance of fundamental TTL and CMOS logic gates.
5. Design simple transistor circuits for practical discrete applications from a performance specification.
6. Carry out circuit analysis experiments using CAD tools such as Multi-Sim in a systematic and informed manner.

**Graduate Attributes: levels of attainment**

- To act responsibly - Enhanced
- To think independently - Attained
- To develop continuously - Enhanced
- To communicate effectively - Attained

### Module Content

Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it.

Digital Circuits is a one semester module taken by Junior Sophister C, CD and D Stream students. It provides a thorough foundation in digital circuits as applied to modern logic device families. The module aims to provide students with knowledge of the operational principles and practical limitations of digital circuits at device and circuit level, as well as instructing them in the analysis and design of these circuits. All of the principles and techniques learned are applicable to the design of digital circuits on a wider scale. During the module, students will develop the analytical and synthesis skills needed to design digital

---

1. TEP Glossary
circuits for electronic equipment intended for any modern application area. In particular C Stream Electronic Engineering students will use these skills later in further circuit and system design modules, while CD Stream Electronic & Computer Engineering and D Stream Computer Engineering students gain the insight needed to appreciate how the design of digital circuits influences and ultimately limits the performance of computers at gate, architectural and system level. The issues encountered ultimately influence factors such as critical paths, throughput rates, instruction cycle times, signal integrity, and data loss which are most important issues in modern computers.

Syllabus:
Semiconductor Electronics: brief revision of fundamental semiconductor laws; current flow mechanisms.
Bipolar Junction Diode: the p-n junction; barrier potential; the ideal diode equation.
Bipolar Junction Transistor: physical principles of operation; device characteristics and parameters.
Bipolar Transistor Inverter: operation of the BJT transistor as a switch; simple inverter circuit; static and dynamic performance characteristics; effects of loading.
BJT Inverter Applications: the design of simple bipolar transistor circuits to act as buffers, drivers and interfaces in a range of applications.
TTL Logic Family: logic characteristics and performance; operating principles of standard 7400 series gates; circuit analysis and power consumption evaluation, Advanced TTL families.
MOS Field Effect Transistor: physical principles of operation; device characteristics and parameters.
MOS and CMOS Inverter: simple resistively loaded MOS transistor inverter, standard p-type /n-type CMOS inverter.
CMOS Logic Family: basic combinational circuits; the CD 4000 series gates.

Teaching and Learning Methods

Assessment Component | Assessment Description | LO Addressed | % of total | Week due
--- | --- | --- | --- | ---
e.g., lectures, seminars, online learning via VLE, field trips, laboratories, practice-based etc...

The module is taught using a combination of lectures, tutorials and a supporting simulation-based laboratory. During the tutorials students will develop their problem solving skills by tackling problems based on the lecture material.
### Assessment Details

Please include the following:
- Assessment Component
- Assessment description
- Learning Outcome(s) addressed
- % of total
- Assessment due date

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Description</th>
<th>Learning Outcomes Addressed</th>
<th>% of Total</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination</td>
<td>2 hour written examination</td>
<td>Nos. 1 - 5</td>
<td>80%</td>
<td>Exam week</td>
</tr>
<tr>
<td>Tutorials</td>
<td>Continuous assessment</td>
<td>Nos. 1 - 5</td>
<td>10%</td>
<td>Weeks 2-12</td>
</tr>
<tr>
<td>Laboratory</td>
<td>Timetabled Simulation Exercise</td>
<td>No. 6</td>
<td>10%</td>
<td>Submission date determined by laboratory attendance</td>
</tr>
</tbody>
</table>

### Reassessment Requirements
Written exam only

### Contact Hours and Indicative Student Workload

<table>
<thead>
<tr>
<th>Contact hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 hours</td>
</tr>
<tr>
<td>Independent Study (preparation for course and review of materials):</td>
</tr>
<tr>
<td>0 hours</td>
</tr>
<tr>
<td>Independent Study (preparation for assessment, incl. completion of assessment):</td>
</tr>
<tr>
<td>100 hours</td>
</tr>
</tbody>
</table>

### Recommended Reading List

### Module Pre-requisite
Successful Completion SF year of BAI programme

### Module Co-requisite

### Module Website
Blackboard

---

2. [TEP Guidelines on Workload and Assessment](#)
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are other Schools/Departments involved in the delivery of this module?</td>
<td>No</td>
</tr>
<tr>
<td>Module Approval Date</td>
<td>19/08/2019</td>
</tr>
<tr>
<td>Approved by</td>
<td>M. J Burke</td>
</tr>
<tr>
<td>Academic Start Year</td>
<td></td>
</tr>
<tr>
<td>Academic Year of Date</td>
<td>2019-20</td>
</tr>
</tbody>
</table>