Module Code	**EEU33C02**
Module Name	**DIGITAL CIRCUITS**
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Declan OLoughlin
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	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	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 Component	Assessment Description	LO Addressed	% of total	Week due

Assessment Details[2]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Examination	2 hour written examination	Nos. 1 - 5	80%	Exam week
Tutorials	Continuous assessment	Nos. 1 - 5	10%	Weeks 2-12
Laboratory	Timetabled Simulation Exercise	No. 6	10%	Submission date determined by laboratory attendance

Reassessment Requirements

Written exam only

Contact Hours and Indicative Student Workload[2]

Contact hours:
50 hours

Independent Study (preparation for course and review of materials):
0 hours

Independent Study (preparation for assessment, incl. completion of assessment):
100 hours

Recommended Reading List

1. Streetman B.G. & Banerjee S., *Solid State Electronic Devices*, 7th ed., Prentice-Hall, 2015.
2. Hodges D. A. & Jackson H. G., *Analysis & Design of Digital Integrated Circuits*, 2nd ed. McGraw-Hill; 1988.
3. Kang S. & Leblebici Y., *CMOS Digital Integrated Circuits*, McGraw-Hill; 1996.

Module Pre-requisite

Successful Completion SF year of BAI programme

Module Co-requisite

Module Website

Blackboard

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	19/ 08/ 2019
Approved by	M. J Burke
Academic Start Year	
Academic Year of Date	2020-21