

ES2D6-15 Semiconductor Materials and Devices

26/27

Department

School of Engineering

Level

Undergraduate Level 2

Module leader

Vishal Shah

Credit value

15

Module duration

10 weeks

Assessment

100% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES2D6-15 Semiconductor Materials and Devices

[Module web page](#)

Module aims

To present, in context, the fundamental properties of semiconductor materials and devices. Students will study fundamental aspects of semiconductor material properties and how these link to device operation, including pn-junction diodes, bipolar transistors, field effect transistors, solar cells, light-emitting diodes and diode lasers. Students will study the basic theory that underpins material properties and the device operation. Students will also study basic fabrication methods. The aim being to cement fundamental semiconductor knowledge in order that more advanced concepts related to devices can be tackled in later years.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

- Physics of doped semiconductor materials extending beyond silicon
- Energy bands, density of states, Fermi distributions, occupancy
- Description of mobility and generation-recombination effects
- Behaviour of diodes, including optoelectronic devices
- Behaviour of bipolar and field effect transistors
- Growth and fabrication technology for electronic devices

Learning outcomes

By the end of the module, students should be able to:

- Critically understand the interaction of different physics in providing new properties and device operation concepts. [C1,M1(D)]
- Solve problems (including numerically) in semiconductor materials and devices. [M2]
- Understand the operation of realistic devices and the effect of non-idealities. [C1,M1(D)]
- Consolidate knowledge of the electronic properties and behaviour of semiconductor materials.
- Analyse the operation of electronic devices (diodes, FETs, BJTs, solar cells, etc.) from the bottom up. [M3], [M12]
- Evaluate the fundamental parameters controlling the properties of semiconductor materials. [M3], [M4]

Indicative reading list

[Reading lists can be found in Talis](#)

Interdisciplinary

Spans the boundaries of Physics and Electronic Engineering, integrating fundamental physics concepts into design, analysis and use of practical electronic components.

Subject specific skills

1. Plan the semiconductor device design process, evaluating outcomes, and working with technical uncertainty.
2. Knowledge and understanding of the need for a high level of professional and ethical conduct in engineering and the use of technical literature, other information sources and industry standards.
3. Ability to apply relevant practical and laboratory skills.

Transferable skills

1. Numeracy: apply mathematical methods to calculate parameters.
2. Apply problem solving skills, information retrieval, and the effective use of general IT

facilities.

3. Communicate (to technical and non-technical audiences) and work with others.
 4. Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
 5. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner.
-

Study

Study time

Type	Required
Lectures	18 sessions of 1 hour (12%)
Seminars	9 sessions of 1 hour (6%)
Practical classes	1 session of 4 hours (3%)
Other activity	1 hour (1%)
Private study	118 hours (79%)
Total	150 hours

Private study description

133 hours of guided independent learning

Other activity description

1 hours revision lecture

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

Assessment component	Weighting	Study time	Eligible for self-certification
----------------------	-----------	------------	---------------------------------

	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus) Examination	100%		No

-
- Answerbook Gold (24 page)
 - Students may use a calculator
 - Engineering Data Book 8th Edition
 - Graph paper

Reassessment component is the same

Feedback on assessment

- Support through advice and feedback hours.
- Cohort-level feedback on final exam.

[Past exam papers for ES2D6](#)

Availability

Courses

This module is Core for:

- Year 2 of UESA-H63W BEng Electronic Engineering
- Year 2 of UESA-H63X MEng Electronic Engineering
- Year 2 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 2 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng

This module is Optional for:

- Year 2 of UCSA-G406 Undergraduate Computer Systems Engineering
- Year 2 of UCSA-G408 Undergraduate Computer Systems Engineering

This module is Option list A for:

- Year 2 of UESA-H112 BSc Engineering
- Year 2 of UESA-HN11 BSc Engineering and Business Studies