DRAFT - Engineering Tripos, Part IIA: Notice concerning Engineering Areas 2016-17

If you wish to qualify in a specific engineering area, at least six modules from your total of ten must fall within one of the engineering areas defined by the Faculty Board. Further information can be found in the Notice concerning Engineering Areas.

The titles of the engineering area for which you are qualified will appear on each of your Part IIA and IIB transcripts. In some cases, you may be qualified for more than one engineering area, in which case all will appear on your transcript. It is not essential that your engineering area at Part IIB will be the same as that at Part IIA.

If you do not wish to choose six modules from an engineering area you may instead qualify in Engineering (i.e. General Engineering). Your choice of modules is less restricted, but you must still follow other requirements about module choices (e.g. sets).

Part IIA Engineering Area requirements: Mechanical Engineering

Students intending to qualify in this Engineering Area must include **at least six** of the modules listed below.

Number	Title
3A1	Fluid mechanics I (double module)
3A3	Fluid mechanics II (double module)
3A5	Thermodynamics and Power Generation
3A6	Heat and Mass Transfer
3B4	Electric Drive Systems
3C1	Materials Processing and Design
3C5	Dynamics
3C6	Vibration
3C7	Mechanics of Solids
3C8	Machine Design
3C9	Fracture Mechanics of Materials and Structures
3D3	Structural Materials and Design
3D7	Finite Element Methods
3D8	Building Physics and Environmental Geotechnics
3F1	Signals and Systems
3F2	Systems and Control
3G2	Mathematical Physiology
3G4	Medical Imaging and Computer Graphics
3G5	Biomaterials
3M1	Mathematical Methods
4C4	Design Methods
4M12	Partial Differential Equations and Variational Methods
4M16	Nuclear Power Engineering

Advice

Mechanical Engineering covers a very broad field: the main areas are mechanics, fluid dynamics, thermodynamics, materials, and design, but topics in control and instrumentation are also relevant. Many students will choose to specialise either in the "dry" side of the subject (mechanics, materials, design) or the "wet" side (fluids and thermodynamics), but combinations of courses can be found to suit many different career paths, some of which cut across this divide. It would be prudent to discuss with the Engineering Area Coordinator before choosing a very eclectic mix of course, in case a lack of overlap makes the workload unusually high.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Professor J Woodhouse

Part IIA Engineering Area requirements: Energy, Sustainability and the Environment

Students intending to qualify in this Engineering Area must include **at least six** of the modules listed below.

Number	Title
3A1	Fluid Mechanics I (double module)
3A3	Fluid Mechanics II (double module)
3A5	Thermodynamics and Power Generation
3A6	Heat and Mass Transfer
3B4	Electric Drive Systems
3D5	Water Engineering
3D8	Building Physics and Environmental Geotechnics
4M16	Nuclear Power Engineering

Advice

Power generation and environmental engineering are central to the advancement of a sustainable future in developed and emerging economies. Energy engineering and sustainability are broad interdisciplinary subjects. This Engineering Area offers the opportunity to draw together modules across electrical, mechanical and civil engineering, underpinned by fluid mechanics and thermodynamics. For example, 3A1 introduces incompressible fluid flows, and 3A5 focuses on power generation in gas and steam turbine plants, and fuel cells. But in parallel, thermofluids may be studied in other application areas, such as buildings and infrastructure (3D5 and 3D8, complemented by part IIB modules such as Architectural Engineering and Sustainable Development). Across part IIA and IIB, this Engineering Area enables students to study the whole power industry and associated technologies (fossil fuel, nuclear and renewable energy).

Students who are planning to take Nuclear Engineering modules in part IIB (4I5, 4I10, 4I11) should take module 4M16 in part IIA.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Prof N Collings

Part IIA Engineering Area requirements: Aerospace and Aerothermal Engineering

To qualify in this Engineering Area, students must select **both 3A1 and 3A3, plus at least two core or companion modules** listed in the tables.

Core modules

Number	Title
3A1	Fluid Mechanics I (double module)
3A3	Fluid Mechanics II (double module)
3A5	Thermodynamics and Power Generation
3A6	Heat and Mass Transfer

Companion modules

Number	Title
3B1	Radio Frequency Electronics
3B2	Integrated Digital Electronics
3C1	Materials Processing and Design
3C5	Dynamics
3C6	Vibration
3C7	Mechanics of Solids
3C9	Fracture Mechanics of Materials and Structures
3D3	Structural Materials and Design
3D4	Structural Analysis and Stability

3D7	Finite Element Methods
3F1	Signals and Systems
3F2	Systems and Control
3M1	Mathematical Methods

Advice

Aerospace and Aerothermal Engineering is an interdisciplinary blend of subjects ranging from fluid mechanics, thermodynamics, structures, instrumentation, control, electronics and design to manufacturing. In essence, Aerospace Engineering is concerned with flight and Aerothermal Engineering with the associated propulsion systems. In the past, development in these fields has been driven by technological issues. In the future, environmental concerns, minimising noise and pollution, and relentless pressure on design and manufacturing turnaround time will force novel solutions and paradigm shifts.

A good understanding of fluid mechanics is essential in both fields. A secure grasp of the fundamentals equips students with the ability and confidence to innovate and develop novel solutions to familiar problems and to understand and maybe manage wholly new issues. 3A1 introduces the dynamics of incompressible fluid flow and is an essential foundation course. High speed flows demand an understanding of compressibility effects and these are discussed in 3A3. 3A5 focuses on the applications of thermodynamics to power generation with emphasis on gas and steam turbine plant, and fuel cells. 3A6 addresses the important topic of heat transfer and mass transfer, with applications.

The essential interdisciplinary nature of the subject is reflected in the diversity of the recommended companion modules drawn from across the spectrum of the department's teaching. This diversity increases in Part IIB.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Professor W.N. Dawes.

Part IIA Engineering Area requirements: Civil, Structural and Environmental Engineering

To qualify in this Engineering Area for 2015-2016, students must select **at least six** of the modules given in the table, and take Surveying Engineering Extension Activity.

Modules

Number	Title
3D1	Geotechnical Engineering I
3D2	Geotechnical Engineering II
3D3	Structural Materials and Design
3D4	Structural Analysis and Stability
3D5	Water Engineering
3D7	Finite Element Methods
3D8	Building Physics and Environmental Geotechnics
3C7	Mechanics of Solids
3C9	Fracture Mechanics of Materials and Structures
4D8	Pre-stressed Concrete **(not running 2016-17)**
4D16	Construction Management **(running 2016-17 not available as a IIB option in 2017/18)**

Surveying Extension Activity

Students intending to qualify in Civil, Structural and Environmental Engineering must choose as their Engineering Extension Activity this 2.5 day course, which may be taken at the end of either Michaelmas or Lent Term. Such students will be given priority, but the course is open to all.

Advice

Intending Civil, Structural or Environmental Engineers are advised to study the broadest possible range of courses in this Engineering Area, and to take all or almost all of the modules available. Students should note that there are many other synergies between these modules, which will make them easier if they are taken as a group – for instance module 3D2 will help to provide further clarification of material presented in 3D1.

Most structures rest on the ground, and therefore need foundations. Vehicles rely on pavements, runways or rails as their foundations, which are strongly influenced by environmental conditions such as groundwater. Engineers working with architects need to rise to the challenge of sustainable design using novel materials in striking configurations, and providing congenial internal environments with high energy-efficiency. Those devising major schemes need to understand the issues of brown field development, flood risk, infrastructure management, and the creation and utilisation of underground space for transport, for example. And those engineers working in resource management may need to understand aquifers and oil reservoirs, or the offshore winds, waves and currents that determine the design of offshore power facilities including windfarms.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Mr F.A. McRobie.

Part IIA Engineering Area requirements: Electrical and Electronic Engineering

Students intending to qualify in this Engineering Area **must include all six** of the modules listed below.

Number	Title
3B1	Radio Frequency Electronics
3B2	Integrated Digital Electronics
3B3	Switch-Mode Electronics
3B4	Electric Drive Systems
3B5	Semiconductor Engineering
3B6	Photonic Technology

Advice

Electrical and Electronic Engineering covers the range of topics which best represents the current trends in circuits, devices and systems for hardware implementations. Module 3B1 introduces the circuit and system design aspects of electronics which operate at radio frequency and are essential in applications such as mobile communications. It also covers advanced circuit concepts used in analogue electronics. 3B2 covers digital circuit and system design together with their implementation in integrated circuits. 3B3 covers the circuits in which transistors operate not only as ON/OFF switches, but where both input and output parameters can vary linearly. Such circuits are particularly relevant for power conditioning. 3B4 covers the operation and design of electrical energy transfer for the drive of motion/actuation systems. 3B5 covers principles of solid state electronic devices ranging from the underlying semiconductor physics to the operating characteristics and design of advanced transistors. 3B6 covers the design principles of systems and devices which operate in the optical frequencies (photonics), and also includes the principles of optical fibre communications.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Prof A Flewitt

Part IIA Engineering Area requirements: Information and Computer Engineering

Students intending to qualify in this Engineering Area must include **at least six** of the modules listed below.

Number	Title
3F1	Signals and Systems
3F2	Systems and Control
3F3	Statistical Signal Processing
3F4	Data Transmission
3G4	Medical Imaging and 3D Computer Graphics
3F7	Information Theory

3F8	Inference
3M1	Mathematical Methods

Advice

Information and Computer Engineering covers the digital representation and processing of signals and systems. It extends from the theory of signals and systems, through to the manipulation of data via computer programs. In addition to all of the information modules, this professional area includes modules from the Computer Science Tripos. Candidates for this area whose main interests are signals, control and communications will include 3F1 and 3F5. Those candidates with an interest in computer systems will focus more on 3F4 and 3F6. Candidates with a strong interest in control should also consider " Instrumentation and Control" as an alternative.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Professor R Prager

Part IIA Engineering Area requirements: Electrical and Information Sciences

Students intending to qualify in this Engineering Area **must include at least eight** of the modules listed below.

Number	Title
3B1	Radio Frequency Electronics
3B2	Integrated Digital Electronics
3B3	Switch-Mode Electronics
3B4	Electric Drive Systems
3B5	Semiconductor Engineering
3B6	Photonic Technology
3F1	Signals and Systems
3F2	Systems and Control
3F3	Statistical Signal Processing
3F4	Data Transmission
3F7	Information Theory
3F8	Inference
3G4	Medical Imaging and 3D Computer Graphics
3M1	Mathematical Methods

Advice

Electrical and Information Sciences covers a very broad area. The B modules cover a wide range of electronic circuits and devices, whilst the F modules cover the digital representation and processing of signals, and the manipulation of data in computers. A student in this area will be seeking to gain a broad overview of systems, from the signals that flow through them to the hardware platforms that implement them. Although many students will choose to do mostly B modules or mostly F modules depending on their inclination towards the electrical or information side, students who specialise exclusively in one or the other should consider one of the other B/F Engineering Areas.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Prof JM Maciejowski

Part IIA Engineering Area requirements: Instrumentation and Control

Students intending to qualify in this Engineering Area **must include 3F1 or 3F2 and at least five** other modules from the list below.

Number	Title
3B1	Radio Frequency Electronics
3B2	Integrated Digital Electronics
3B5	Semiconductor Engineering
3B6	Photonic Technology
3C5	Dynamics

3C6	Vibration
3F1	Signals and Systems
3F2	Systems and Control
3F3	Statistical Signal Processing
3F4	Data Transmission
3F7	Informationn Theory
3F8	Inference
3G4	Medical Imaging and 3D Computer Graphics
3M1	Mathematical Methods

Advice

Instrumentation and Control covers a range of topics which are important to the monitoring and control of modern systems. B modules cover basic circuits and device technology and F modules cover the representation, capture and manipulation of signals. The C modules cover the relevant engineering aspects of mechanical systems.

Students are strongly advised to take **both 3F1 and 3F2**.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Professor JM Maciejowski

Part IIA Engineering Area requirements: Bioengineering

Students intending to qualify in this Engineering Area **must include at least six** of the modules listed below and must take **at least three modules from 3G1, 3G2, 3G3, 3G4 and 3G5.**

Number	**Title**
3G1	Introduction to Molecular Bioengineering
3G2	Mathematical Physiology
3G3	Introduction to Neuroscience
3G4	Medical Imaging and 3D Computer Graphics
3G5	Biomaterials
3C7	Mechanics of Solids
3D7	Finite Element Methods
3F1	Signals and Systems
3F3	Statistical Signal Processing

Advice

From quantitative biology to improving clinical practices, Bioengineering presents an ever-important discipline which will transform future medicine and healthcare.

The integration of fundamental engineering principles with latest technologies in the digital and biomedical arena is a unique feature of the Bioengineering subject area. The module selection allows those who wish to specialise in Mechanics, Materials and Bioengineering to take modules such as 3G1, 3G2, 3G4, 3G5, 3C7 and 3D7 and those who wish to specialise in Information Processing and Bioengineering to take modules such as 3G1, 3G2, 3G3, 3G4, 3F1, and 3F3. A broad training in both areas can be accomplished by a combination of the modules specified.

Specialist advice on this Engineering Area can be obtained from the Engineering Area coordinator, Dr A Kabla

Part IIA Engineering Area requirements: Engineering

Students intending to qualify in this Engineering Area in Part IIA may choose any set of modules subject to the restrictions given in COMET.