Module Specification

Scientific Basis of Engineering

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Contents

Part 1: Information

Module title: Scientific Basis of Engineering

Module code: USSKL6-30-1

Level: Level 4

For implementation from: 2020-21

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Health & Applied Sciences

Department: HAS Dept of Applied Sciences

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Applied Sciences

Module type: Standard

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Not applicable

Features: Not applicable

Educational aims: See Learning Outcomes

Outline syllabus: Indicative content includes:

Basic Mechanics

Fundamental concepts; Units of measurements; International system of units; numerical calculations.

Force Mass and acceleration.

Work Energy and Power.

Effects of force on Materials.

Moments:
Equilibrium of a particle; free body diagram; force system resultants; principle of moments; moment of a force; moment of a couple; Resultant forces and couples; equilibrium of planar system of forces; graphical and analytical method.

Internal forces:
Shear and moments; relation between distributed load, shear and moment; stress and strain; tensile and compressive stress and strain; factor of safety.

Hooke's Law and elastic constants.

Friction:
Dry friction; frictional forces on screws, belts and bearing, rolling resistance, lubrication.

Moment of area:
First and second moments; polar second moment of area; centroids; theorem of perpendicular axis.

Bending of beams:
Stresses due to bending, neutral axis, radius of curvature, moment of resistance, general bending formula.

Principles of finite element analysis.

Torsion of shafts:
Stresses due to top twisting, angle of twist, general torsion formula, power and work.

Simple Harmonic Motion.

Rigid body dynamics.

Simple Machines.

Heat, Energy and Transfer.

Tools:
Tool types, selection and use.

Safe working mechanical engineering practice.

Electronics

Concepts of electricity and magnetism, structures of matter and its properties.

SI Units and Laws associated with electrical and electronic engineering.

Conductors and Insulators.

Semiconductor Theory.

Circuit components and associated symbols.

Elementary Analogue Circuits:
Resistive, Capacitive and inductive, oscillators, amplifiers, including op amps, power amplifiers, power circuits including transformers.

Feedback, stability and noise.

Basic transducer theory.

Motors – Alternating Current (AC), Direct Current (DC), Stepping, pumps and their control and feedback circuits and systems.

Elementary Digital systems:
Logic theory.
Digital circuits, functions.
Programmable devices.
Microprocessor/Microcontroller.
Interfacing with Microprocessor/microcontroller.
Programming of Microprocessor/microcontroller.
Application to simple control problems.

Signal Processing and manipulation:
Signal conditioning e.g. Amplification, filtering, clipping, modulation.
Signal sampling - simple sample-and-hold/track-and-hold devices.
Analogue to digital and digital to analogue converters.
Voltage-to-frequency and frequency-to-voltage converters.
Signal Isolation principles.
Analogue line drivers and receivers.

Part 3: Teaching and learning methods

Teaching and learning methods: There will be 3 weeks of contact time at UWE in 3 x 1 week blocks. Included in each block week are laboratory workshops, lectures and tutorials. The contact time will equate to approximately 6 hours per block (a total of 18 hours).

In addition to the allocated hours on campus learning, students will engage in

synchronous and asynchronous online learning. This will comprise a total of approximately 54 hours of online engagement through a combination of lectures, synchronous online tutorials, synchronous and asynchronous discussions, online quizzes, and collaborative group work.

The strategy of this module is to provide a platform for students to gain an understanding of the scientific basis of engineering.

Students are expected to spend 72 hours on scheduled learning and 228 hours on independent learning. Theoretical material within the module will be presented to the students in the form of regular lectures throughout each of the semesters in the academic year. During those times of work based learning, these lectures will be delivered online and involve a number of technological enhancements. The learning of lecture content will be reinforced through time spent in independent learning by the directed reading of recommended texts and through the use of technology enhanced learning resources that will be provided online.

This online learning and engagement will be delivered through several avenues:
Synchronous online tutorials in protected learning time where the student will contribute/attend an online activity appropriate to the content at the time at which the academic will be present online to facilitate and lead this scheduled/timetabled session. This tutorial will be themed/planned.
Asynchronous discussions in the student's own time (or during protected time where permitted and appropriate) where they will engage/collaborate with other students on the course or in specified groups, and in which the academic is permitted to moderate where necessary, but is not expected to contribute.
Synchronous surgery sessions timetabled for a specific time in which the academic will be available online to answer live questions via discussion boards/blogs/collaborate or to respond to questions posted/asked prior to the session.
Interactive, online formative quizzes made available either following a particular package of knowledge exchange/learning, or in specified sessions/time periods.
Lectures delivered online through a combination of one or more of the following: visual/audio/interactivity/personal formative assessment.

A number of relevant practical sessions will be incorporated during the campus based blocks in addition to the work based learning that must be achieved under supervision by a workplace supervisor. Practical sessions will both drive hands on learning and the acquisition of technical skills at both an individual and group working level.

The remainder of the independent learning time allocated to the module should be spent preparing written assessments for submission (B1, B2), and undertaking revision for the exams (A1, A2).

Scheduled learning includes lectures, seminars, tutorials, project supervision, demonstration, practical classes and workshops; fieldwork; external visits; work based learning; supervised time in studio/workshop.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc. These sessions constitute an average time per level. Scheduled sessions may vary slightly depending on the module choices you make.

Module Learning outcomes:

MO1 Explain the fundamental principles of applied mechanics

MO2 Solve basic mechanical problems using the application of force

MO3 Have the knowledge to select the appropriate tools to perform basic mechanical tasks

MO4 Explain electric and magnetic fields and the basic laws which underpin them

MO5 Explain basic analogue and digital electronic components, circuits and systems

MO6 Explain basic amplifier circuits for linear and non-linear applications

MO7 Explain a range of basic factors will influence the signal quality and describe signal processing and signal manipulation

MO8 Describe the architecture of microprocessors and programmable devices

MO9 Explain the basic principles of interfacing a device to a microprocessor or programmable device and write a very simple microprocessor/programmable device program

MO10 Interpret basic circuit diagrams, recognising some common configurations

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/usskl6-30-1.html

Part 4: Assessment

Assessment strategy: The Assessment Strategy has been designed to support and enhance the development of both subject-based and more general skills, whilst ensuring that the modules learning outcomes are attained, as described below.

Component A
The online exams will provide students with an opportunity to demonstrate both their knowledge on a broad range of topics through a series of short answer questions, and more in-depth knowledge though a selection of medium length questions.

Component B
The integrated mechanics assignment will provide an opportunity for students to demonstrate their ability to apply the principles of basic mechanics to unseen problems and evidence their skills in approaching it appropriately. The second element allows students to apply their knowledge and identify examples of how the

principles of electronics underpin Clinical Engineering, through preparation and defence of a poster.

Formative feedback is available to students throughout the module through group discussions, and in workshops. Students are provided with formative feed-forward for their exam through a revision and exam preparation session prior to the exam and through the extensive support materials supplied through Blackboard.

All work is marked in line with the Department's Generic Assessment Criteria and conforms to university policies for the setting, collection, marking and return of student work. Where an individual piece of work has specific assessment criteria, this is supplied to the students when the work is set.

This assessment strategy has been designed following best practice on effective assessment from JISC (http://www.jisc.ac.uk/whatwedo/programmes/elearning/assessment/digiassess.aspx) and The Open University's Centre for Excellence in Teaching and Learning.

Technical design and deployment of the activities will also follow best practice developed at UWE by the Education Innovation Centre in collaboration with academic colleagues across the university. Staff guidance and support are already in place (https://info.uwe.ac.uk/online/Blackboard/staff/guides/summative-assessments.asp).

Assessment components:

Practical Skills Assessment - Component B (First Sit)
Description: Integrated mechanics assignment
Weighting: 30 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Poster - Component B (First Sit)

Description: Poster presentation and defence (20 minutes)
Weighting: 30 %
Final assessment: No
Group work: No
Learning outcomes tested: MO6, MO7, MO9

Examination (Online) - Component A (First Sit)
Description: Exam 1 (24 hours)
Weighting: 20 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6, MO7

Examination (Online) - Component A (First Sit)
Description: Exam 2 (72 hours)
Weighting: 20 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO10, MO8, MO9

Practical Skills Assessment - Component B (Resit)
Description: Mechanics exercise and electronics case study
Weighting: 60 %
Final assessment: No
Group work: No
Learning outcomes tested:

Examination (Online) - Component A (Resit)
Description: Online Examination (24 hours)
Weighting: 40 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Healthcare Science (Radiation Engineering) {Apprenticeship-UWE}[Sep]FT][Frenchay][3yrs] BSc (Hons) 2020-21

Healthcare Science (Rehabilitation Engineering) {Apprenticeship-UWE}[Sep]FT][Frenchay][3yrs] BSc (Hons) 2020-21

Healthcare Science (Rehabilitation Engineering) {Apprenticeship-UWE}[Sep]FT][Frenchay][3yrs] BSc (Hons) 2020-21

Healthcare Science (Renal Technology) {Apprenticeship-UWE}[Sep]FT][Frenchay][3yrs] BSc (Hons) 2020-21