MODULE SPECIFICATION

Module Code:	ENG5AK

Module Title:	Power, Distribution and System Design

Level:	5	**Credit Value:**	20

Cost Centre(s):	GAME	JACS3 code: HECoS code:	H632 100166

Faculty	FAST	**Module Leader:**	Yuriy Vagapov

Scheduled learning and teaching hours	30 hrs
Guided independent study	170 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BEng (Hons) Industrial Engineering Design (Electrical & Electronic)	✓	☐

Pre-requisites
None

Office use only
Initial approval: 11/09/19 Version no:1
With effect from: 11/09/19
Date and details of revision: Version no:4
30/01/20 admin update of derogation
12/8/20 Temporary change to assessment for 2020/21 post Covid.
22/9/21 Temporary change to assessment extended for 21/22

Module Aims
To provide knowledge and understanding of (i) current provision in the generation, distribution, protection, utilisation and sustainability of electrical energy and (ii) the customer's needs - and their effects - in terms of mains power distribution and efficiency.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

	At the end of this module, students will be able to	Key Skills	
1	Analyse the power supply needs of the modern industrial consumer	KS3	
2	Determine, explain and quantify factors affecting efficiency in terms of generation and consumption	KS6	
3	Apply appropriate methods of calculation to design, install and maintain a power source for the industrial consumer	KS10	
4	Determine appropriate sustainable power sources and where they can be utilised in an industrial setting.	KS6	KS7

Transferable skills and other attributes

Reflective practice skills and problem solving
Time management and organisation
Information handling
Communication

Derogations

A derogation from regulations has been approved for this module which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Assessment:

Indicative Assessment Tasks:

Assessment 1 - The case study involves research into hypothetical scenarios with given data, relating to an analysis of performance of electrical power system. It could involve evaluation of efficiency, reliability and economical aspects. The case study should cover the broad concepts along with the depth of study relating to a particular electrical power system.

Assessment 2 - The theoretical aspects of the delivery will be assessed by means of an in course test, this will be closed book and the students will be expected to recall formulae necessary for calculations. The in course test will involve the application of appropriate formulae in order to determine solutions relating to generation and distribution of electrical energy

Post Covid-19 Temporary modification valid for 20/21 and 21/22:

Assessment 1: As above.

Assessment 2: A portfolio of work covering assignment based tasks covering learning outcomes 3 and 4. Examples of assessment may include practical based laboratory work, case study investigation, engineering design calculations and multiple choice quizzes via the module VLE site.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration or Word count (or equivalent if appropriate)
1	1, 2	Case Study	50%	2500
2	3, 4	In-class Test	50%	2 hrs
Post Covid-19 Temporary modification valid for 20/21 and 21/22:				
1	1, 2	Case Study	50%	2500
2	3, 4	Portfolio	50%	2000

Learning and Teaching Strategies:

Lectures - presentation of theory, facts and concepts, relating to engineering science, in order to convey critical information. Interaction or active learning should be implemented to develop an understanding of principles and concepts and stimulate discussion.

Tutorials – Close interaction with students ensuring that the work presented during lectures has been understood, with specific help being given in order to overcome any learning problems, should they occur.

Demonstrations – Laboratory experiments performed in order to demonstrate engineering science principles being applied.

‘Break out sessions’ and guest lecturers will be used to cover specific elements for sub-groups within the cohort.

Syllabus outline:

Electromagnetism and Energy Conversion: Magnetic field, Force on current currying wire, Magneto-motive force, Magnetic circuits, Faraday law, Magnetic materials, Magnetisation curve and hysteresis, Hysteresis loss, Eddy current loss;

Transformers: Principles, Ideal transformer, Transformer ratio of turns, emf equation, Equivalent circuit, Determination of transformer parameters, Copper and core losses, Power flow diagram, Efficiency, Voltage regulation;

Three Phase Systems: Generation of three-phase voltages, Star and delta connected loads, Balanced and unbalanced three phase systems, Three phase transformers, Star and delta connection of three phase transformer windings, Active, reactive and apparent powers;

Power Factor: Power factor problem, Measurement of power and power factor, Methods of power factor improvement;

Electricity Generation and Tariffs: Power plants, Economics of electricity supply, Cost of electricity, Structure of tariffs, Maximum demand, Load factor, Diversity factor;

Transmission: Types of transmission lines, Impedance of transmission line, Equivalent circuit of transmission line, Losses in transmission lines;

Distribution and Electrical Power Protection: Industrial supplies and installation. Protection of industrial plants, Calculation of a short circuit fault;

Sustainable Energy: Alternative and renewable sources of energy, Wind turbines, Solar panels, Fuel cells, hydraulic turbines.

Bibliography:

Essential reading

Wildi, T. (2013) Electrical Machines, Drives and Power Systems, 6th Edn., Pearson

Other indicative reading

Weedy, B.M. (2012) Electric Power Systems , 5thEdn., Wiley

Pabla, A.S. (2012) Electric Power Distribution, 6th Edn., McGraw-Hill

Schavemaker, P. and van der Sluis, L. (2016) Electrical Power System Essentials, 2nd Edn., Wiley