

## Liverpool John Moores University

Title: FUNDAMENTALS OF MECHANICS AND ELECTRICAL CIRCUITS  
Status: Definitive  
Code: **4500ICBTMT** (127034)  
Version Start Date: 01-08-2021  
  
Owning School/Faculty: Engineering  
Teaching School/Faculty: ICBT, Colombo

Team	Leader
Alison Cotgrave	Y

**Academic Level:** FHEQ4      **Credit Value:** 15      **Total Delivered Hours:** 86  
**Total Learning Hours:** 150      **Private Study:** 64

### Delivery Options

Course typically offered: Semester 2

Component	Contact Hours
Lecture	45
Practical	12
Tutorial	15
Workshop	12

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Practice	AS1	Practical (1500)	30	
Exam	AS2	Examination	70	2

### Aims

*The various sources and forms of energy are discussed and the principles governing mechanics, AC electrical circuits, energy conversion and electrical transmission are described. The course covers four main topics:*

*Mechanical definitions, basic mechanics and DC machines  
 DC and AC circuit theory including real and reactive power  
 The demand for electrical energy and conventional and renewable forms of electrical generation and their impact on the environment  
 Why the existing electrical power system has its present structure*

## **Learning Outcomes**

After completing the module the student should be able to:

- 1 Identify AC and DC circuit theory and basic principles of mechanics to solve series and parallel RL-C circuits.
- 2 Describe the principles of conventional and renewable electricity generation and the matching of generation and demand.
- 3 Explain simple mechanical and electrical systems.
- 4 Identify the DC and AC circuit analysis in the laboratory with the use of computer simulation software and laboratory equipment.

## **Learning Outcomes of Assessments**

The assessment item list is assessed via the learning outcomes listed:

Practical	4		
Examination	1	2	3

## **Outline Syllabus**

*Mechanics And Electrical Machines : Units and dimensions; velocity and acceleration; resolution of forces; Newton A circ's laws of motion; torque; friction; systems in equilibrium; energy (potential and kinetic); power; angular motion; conversion of energy; momentum; thermal energy; simple harmonic motion; damped and forced oscillations, force production in machines, DC machines.*

*Circuit theorems: Norton; Kirchhoff; Thevenin; superposition; maximum power.  
 Circuit analysis: mesh; nodal; maximum power transfer; impedance matching.  
 Phasor diagram to analyse the single phase circuits.  
 Complex notation in the analysis of single phase circuits.  
 Circuit performance: tolerance; effect of changes in component values*

*Two-port network models*

*Network models: symmetrical two-port network model; characteristic impedance,  $Z_0$ ; propagation coefficient (expressed in terms of attenuation,  $\alpha$ , and phase change  $\beta$ ); input impedance for various load conditions including  $Z_L = Z_0$ ; relationship between the neper and the dB; insertion loss*

*Symmetrical attenuators:  $T$  and  $\pi$  attenuators; the expressions for  $R_0$  and  $\alpha$  in term of component values*

*Electrical Power Systems: The use ac rather than dc transmission, Structure of*

*transmission and distribution networks, 3 phase systems. Calculation of voltage and flows in a two-bus system and Transmission capacity.*

*Use of software package (i.e OrCad/pspise or similar industrial based software) to simulate the basic R-C, R-L and R-L-C circuit and analyse the circuit performance by measuring current voltage and power for DC/AC circuits. Design and demonstrate basic R-C, R-L and R-L-C circuit in the laboratory and analyse the circuit performance by using signal generator, oscilloscope and mustimeters.*

## **Learning Activities**

Students will be supported in their learning, to achieve the above learning outcomes, in the following ways:

Electrical circuit theory acquired through lectures, seminars, tutorials and group work.

Electrical circuit measurement test using simulation by appropriate learning software in computer laboratory classes.

Electrical circuit test using appropriate testing equipment in laboratory classes.

## **Notes**

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