RMIT UNIVERSITY

## A. COURSE IDENTIFICATION

1. **Course name: Differential Equations & Matrixes**
2. **Subject area and Catalogue Number: BUSM 6021L**
3. **Program name**:

   ***UTE 6 02 99 Advanced Diploma of Electrical Engineering***

4. **Program code: C6050**
5. **Owning Department/School/Centre: School of Infrastructure, Electrotechnology and Building Services**

6. **Contact detail: *School of* Electrotechnology and Building Services**

   GPO Box 2476V, Melbourne 3001
   PHONE: 99254727 FAX: (03) 9663 7974
   Email:electrotech@rmit.edu.au

7. **Duration: 60 hours**
8. **Mode of delivery: On Campus**
9. **Campus: City**
10. **Normal Semester Start: February or July**

## B. COURSE SUMMARY

Students will develop fundamental mathematical skills necessary to support articulation into tertiary studies in engineering. It involves mathematical objects such as differential equations, matrices and series, which are needed by electronic engineer.

This learning unit is one of a group of units designed to collectively meet underpinning skill & applied knowledge essential for developing the following Core Competency –

***UTE NES 008A – Provide technical leadership in the workplace***

Which is contained in the National Electrotechnology Training Package UTE99
*http://www.anta.gov.au/tp*

## C. CURRICULUM BASE

This course cover the theory and application for the following mathematical concepts:

- Differential Equations
- Taylor polynomials, infinite series, power series
- Matrix algebra

- Functions of several variables

Demonstrating leadership skill in the simulated workplace and apply the following leadership concepts:

- Provide technical expertise, both written and orally
- Building and maintain team
- Organising project

## D. COURSE OUTCOME

Students are expected to

- **Meet only basic performance requirements of the competency (and its elements) at this level, i.e.**

***UTE NES 008A – Provide technical leadership in the workplace***

- *008.1 Demonstrate standards of performance*
- *008.2 Maintain personal competence*
- *008.3 Organise personal work priorities*

- **Demonstrate analytical skill in Differentiation and Matrices mathematical concepts, practical skills in planning and organising work to meet time-line and quality standards. Ability to work and communicate information clearly with the team, provide conflict resolution and problem solving to the team.**

- **Demonstrate application of the following generic or Key Competencies within the practical activities and work performance simulations _**
  - Collect, analyse and organise information.
  - Communicate ideas and information *((testing & evaluation procedures)*
  - Plan and organise activities *(lab & simulation activities)*
  - Work with others and in teams *(lab & simulation activities)*
  - Apply mathematical ideas and techniques *(calculations)*
  - Solve problems
  - Use technology

## E. KEY FEATURES OF LEARNING EXPERIENCES

Students will participate face to face in using differential equations, various series concepts and matrix algebra to solve problems, using computer as a tool to solve mathematical functions. Students will participate in team building activities, clear and concise dissemination of ideas and information to team member and supervisor, planning and organising work to meet time, personnel requirements and contingencies.

## F. KEY FEATURES OF ASSESSMENT

Assessment requirements include

- Attendance and satisfactory completion of prescribed practical exercises, which **may be scheduled during the day or evening** depending on the demand.
- Evidence of participation in and satisfactory completion of work simulation projects.
- Satisfactory completion of class assignment work
- Progressive tests
- Timely submission and standard presentation for all assessment material / documentation

### Special circumstances

**Any variation to assessment requirements must be negotiated and documented with class instructor or Program Manager**

### Plagiarism

The presentation of another person's work, idea or creation as one's own and without appropriate referencing is not acceptable. The use of another person's work or ideas must be acknowledged. Failure to do so may result in not passing the program

## G. COURSE REQUISITES AND SPECIAL ENTRY

**PRE-REQUISITE**

Calculus and Vectors

## H. RECOGNITON AND CREDIT TRANSFER

The amount of credit given for recognition of prior learning will be determined on a case-by-case basis.

## I. COURSE COST

Fees are calculated at $1.30 per standard contact hour. The minimum fee a student may pay for a calendar year is $54 and the maximum is approximately $620. **Exact fees are calculated at the time of enrolment**

## J. RESOURCES

***LEARNING RESOURCES.***

The recommended learning resources will be made available during the program.

## K. STUDENT RIGHTS, RESPONSIBILITIES AND SUPPORT

Refer to RMIT Web site: http://www.rmit.edu.au/ for information regarding to Student rights and responsibilities, Learning Support Unit & Other support (counseling, disability, etc), Student Union, student Policy and leave of absence/deferral.

## L. PLANNED STUDENT LEARNING EXPERIENCES

### Learning Activities:

Students will participate face to face in

- **Classroom tutorial activities** to consolidate the theory of differential equations, series, matrices mathematical concepts, which may include manipulation of mathematical table and application of differential equation to electrical signal.

- **Practical activities** to develop skill in using computer software to numerically evaluate various equations. Develop testing procedure to verify the performance, diagnoses and debug of faults in the program.

- **Work simulation projects** focus in technical leadership activities, which include: team building, identify team member's work task, clear and concise dissemination of ideas and information, planning and organising work to meet quality standards, time-line, personnel requirements and contingencies. Demonstrate leadership characteristic, such as: conflict resolution and problem solving, ability to conduct and participate in meetings, keeping records and documenting tasks.

  Project may be undertaken as **part of a team or individual basis.**

## M. ASSESSMENT

### Assessment Tasks and Criteria

Assessment activities will be as close as practicable to real work situations and will require "real work" type decision-making by the student. Evidence of competent performance shall be gathered from

- **Work performance simulations**

These projects have to demonstrate the applied knowledge required to meet assessment criteria and technical requirement specified in the following competency standard:

**NES 008 A – Provide technical leadership in the workplace**

- *008.1 Demonstrate standards of performance*
- *008.2 Maintain personal competence*
- *008.3 Organise personal work priorities*

When performing the simulations, students must demonstrate ability to:

- Organise and manage the tasks within the simulations
- Cope with any contingencies that arise during the simulations and solve inherent problems
- Perform tasks autonomously and/or as a member of a team as task proscribes
- Perform task and manage work environment/equipment according to safe working practice and OH&S requirements.
- Meet assessment criteria, conditions and technical requirement relevant to the competency standard detail above.

- **Practical exercises**

These will be assessed progressively according to individual task criteria. All practical exercises must be

- Undertaken according to safe working practice as specified by the Centre.
- Performed according to specified laboratory standards and practice.

- **Progressive and Validation Tests**

Theoretical concept underpinning measurement and testing procedures will be **assessed progressively in tests throughout the unit. A written/ oral validation test will also apply to aspects of projects done in groups**

**Although this learning unit will be assessed on completion, the competency itself will not be signed off until this and further learning units are completed and the student is deemed competent.**

**Percentage of assessment**

- Written assessment. (100%)
- A Pass in the Learning Unit when evidence of learning is collected according to the requirements as stated at "assessment criteria". The documentation must be clearly communicated and submitted to supervisor within specified time.

**Assessment review**:

Request for review of the assessment should be applied in writing to the Head of Centre within a month of official notification of the result.

## N. SUPPLEMENTARY INFORMATION FOR ENROLLED STUDENTS

Some resources to assist student learning and assessment will be placed on Training Centre's internal network; student will need student's login number and password to access this information.

***INTERNET RESOURCES:***

Student can use any resources he/she likes to assist with the study. The web is especially rich in information that will assist student in understanding the work he/she is doing. To access this information, the student will need to use a search engine. Students should make a habit of using these regularly to expand learning horizons beyond the resource material found in this module. Some common search engines are

- http://www.yahoo.com
- http://www.google.com

## O. SUPPLEMENTARY INFORMATION FOR STAFF

### ASSESSMENT

- **Work performance simulations**

These projects have to be undertaken **toward the end of the unit, in a controlled environment for the specified duration in order to perform tasks autonomously and/or a member of a team**.

In judging work performance it is essential that evidence regarding the following aspects of competency be incorporated:

**NES008A Provide technical leadership in the workplace**

- *008.1* Demonstrate standards of performance.
  - **Demonstrate completion of task to appropriate mathematical standard.**
  - **Provide technical expertise, clear and concise dissemination of mathematical information is communicated to supervisor and colleagues.**
- *008.2* Maintain personal competence
  - **Involve in long life learning**
  - **Undertake ongoing professional technical and leadership development**
  - **Conflict resolution and problem solving ability**
- *008.3* Organise personal work priorities.
  - **Organise work and job time-lines**
  - **Manage project to meet dead lines**
  - **Cope with work contingencies**
  - **Prioritise job according to appropriate criteria.**

It is expected that the assessor would require approximately 4 hours to evaluate all evidence from the assessment activities relevant to the competency.

In making a final judgement about a learner's competence the Registered Training Organisation (RTO) must make sure that such judgement is made on **sufficient evidence** being presented. This evidence should be from a number of quantitative and qualitative events and over a period showing the development of competent work performance by the learner.

**Course Content (*Skills & Applications*):**

1. **Differential Equations:**
   - First order differential equations:
     - separable and liner types
     - applications to dynamics
     - circuit theory
     - exponential growth/decay problems
     - mixing problems
     - Newton's law of cooling, etc.
   - Second order differential equations:
     - homogeneous liner equations having constant coefficients non-homogeneous equations
     - particular integrals corresponding to right hand sides which are polynomials, exponentials, cos ax, sin ax
     - applications to electrical and/or mechanical oscillations

2. **Taylor polynomials, infinite series, power series**
   - Taylor polynomials:
     - error term
       concept of convergence of an infinite series
   - infinite series
     - sequence of partial sums
     - necessary condition for convergence positive term series
     - comparison test (simple cases only)
     - ratio test, $n^{th}$ root test
     - alternating series
     - absolute convergence
   - power series
     - radius of convergence
     - operations with power series
     - manipulation of standard series given in tables

3. **Matrix algebra**
   - matrix algebra

- inverse using row operations
- Solution of systems of linear equations using row operations
- Interpretation of matrix as a mapping:

- Reflections
- Dilations
- Rotations
- Determinates
- Eigenvalues and eigenvectors
- Applications

4. **Functions of several variables**

- surfaces (cylinder, sphere, cones, paraboloids)
- partial derivatives
  - geometrical interpretation
- space curves
  - tangent vector
  - arc length
  - velocity and acceleration
- chain rule
- directional derivatives
  - gradient
  - normal vector of a surface
  - tangent plane
  - normal line
- errors
- maxima/minima of z=f(x,y)
- double integrals
  - interpretation as a volume

**Evidence of Learning**

Evidence of competent performance shall be gathered from

- Written tests.
- Practical activities related to program construction and documentation of all relevant steps.

Assessment activities shall be as close as practicable to real work situations and include real work decisions by the learner.