FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

END OF SEMESTER EXAMINATION

MODULE CODE: MA4702

SEMESTER: Spring 2015

MODULE TITLE: Technology Mathematics 2

DURATION OF EXAM: 2.5 hours

LECTURER: Kevin O'Brien

GRADING SCHEME: 100 marks
70% of total module marks

EXTERNAL EXAMINER: Prof. John King

INSTRUCTIONS TO CANDIDATES

This paper is comprised of six questions. Question 1 is compulsory and is worth 40 Marks. You must also attempt any four of the other five questions, each of which are worth 15 marks.
Scientific calculators approved by the University of Limerick can be used.
Formula sheet and statistical tables are provided.

Question 1 - Short Questions

Question 2 - Limits and Functions

Question 3 - Curve Sketching

Question 4 - Sequences and Series

Question 5 - Integration

Question 6 - Applications of Integration and Partial Derivatives

Formula Sheet

Logarithms

If $a^b = c$ then $\log_a c = b$.

Sum and Difference of Two Cubes

$$a^3 + b^3 = (a - b)(a^2 - ab + b^2)$$
$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Sequences and Series

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

Arithmetic Series Summation:

$$S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

Geometric Series Summation:

$$S_n = a\left(\frac{1 - r^n}{1 - r}\right)$$

$$S_\infty = \frac{a}{1 - r}$$

Ratio Test

For a series with general term u_n, if

$$\lim_{n\to\infty} \left|\frac{u_{n+1}}{u_n}\right| = r$$

then the series converges (absolutely) if $r < 1$

Curve Sketching

Horizontal Asymptote: The horizontal asymptote is computed as

$$\lim_{x\to\infty} f(x)$$

Maclaurin Series

$$f(x) = f(0) + f'(0) + \frac{f''(0)}{2!} + \frac{f''(0)}{2!} + \frac{f'''(0)}{3!} + \ldots$$

Hyperbolic Functions

$$\cosh(x) = \frac{e^x + e^{-x}}{2}$$

$$\sinh(x) = \frac{e^x - e^{-x}}{2}$$

Rules of Differentiation

Product Rule: with $y = uv$

$$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$$

Quotient Rule:

$$y = \frac{u}{v}$$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

Chain Rule:

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

Integration

Integration by parts:

$$\int udv = uv - \int vdu$$

Further formulae and special cases on pages 41 & 42 of the log tables provided.

Dynamics

Where $s(t)$ denotes displacement at time t, $v(t)$ denotes the velocity at time t and $a(t)$ denotes the acceleration at time t,

$$\frac{ds(t)}{dt} = v(t),$$

$$\frac{dv(t)}{dt} = a(t).$$

Electrical Circuits

Where $q(t)$ denotes the charge at time t and $i(t)$ denotes the current at time t,

$$\frac{dq(t)}{dt} = i(t).$$