Summer Examinations 2016

ENG105116N

Module Title: Mathematics for Engineers
Level: Four
Time Allowed: Two hours

Instructions to candidates:

• Enter your student number **not** your name on all answer books.
• Answer **all** questions.
• Please show **all** of your workings for **all** questions.
• Where a question has more than one part the division of marks is stated.
• Begin each answer in a separate answer book, label each answer book clearly with the number of the question you are answering.
• The use of electronic calculators of an approved type is permitted.
• Formula booklet and graph paper will be provided.

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Answer all questions.

Please show all of your workings for all questions.

1. By dividing the interval into twenty strips, use Simpson’s Rule to find an approximate value for the integral:

\[
\int_{-1.0}^{1.0} \frac{1}{\sqrt{4 - 2 \sin x}} \, dx
\]

where \(x\) is measured in radians

(20 marks)

2. Find all the first and second partial derivatives of \(z = e^{4x+3y} + 2xy + 3\)

(15 marks)

3. Evaluate by parts the integral

\[
\int x^2 \ln(x^3) \, dx
\]

(15 marks)

4. Solve the differential equation for \(y\) as a function of \(x\)

\[
3xy + 3x - y - 1 = (x^2 - 1) \frac{dy}{dx}
\]

when \(y = 0\) where \(x = 0\).

(25 marks)

5. Solve the second order differential equation

\[
\frac{d^2x}{dt^2} + 5 \frac{dx}{dt} - 6x = \sin 2t
\]

and use the initial conditions that when \(t = 0, x = 0\) and \(dx/dt = 0\) to determine the value of the constants of integration.

(25 marks)

6. Given that \(x(0) = 3\) convert the differential equation \(\frac{d^2x}{dt^2} - 5 \frac{dx}{dt} + 6x = e^{2t}\) into its Laplace transform form and hence formulate a solution to the differential equation.

(25 marks)

End of Paper