MID-SEMESTER ASSESSMENT PAPER

MODULE CODE: MA4002	SEMESTER: Spring 2017
MODULE TITLE: Engineering Mathematics 2	DURATION OF EXAMINATION: 45 minutes
LECTURER: Prof. N. Kopteva	PERCENTAGE OF TOTAL MARKS: **25%**

Please, do NOT open this paper

until ANNOUNCED by your lecturer

EVERYBODY IS SUPPOSED TO START AT THE SAME TIME

1 (a) Evaluate the indefinite integral $\displaystyle\int \frac{x^2}{\sqrt{x^3+1}}\,dx$.
Hint: use an appropriate substitution. 2%

(b) Calculate the area between $y = 3^x - \dfrac{1}{x+1}$ and the x-axis for $0 \le x \le 1$. 2%

(c) Express as a definite integral and then *evaluate* the limit of the Riemann sum $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n} \sin(2c_{i-1})\,\triangle x$, where $c_i \in [x_{i-1}, x_i]$, and we use the partition P with $x_i = -1 + \dfrac{3i}{n}$ for $i = 0, 1, \ldots, n$ and $\triangle x \equiv x_i - x_{i-1}$. 2%

(d) Evaluate $\dfrac{d}{dx}\left(\displaystyle\int_{2x}^{\cos x} \sqrt{\sin t + 1}\; dt\right)$. 1%

(e) Find an upper bound for the error E_S in the Simpson's Rule approximation of the definite integral $\displaystyle\int_1^2 \cos(\sqrt{3}\,x)\,dx$, using N subintervals. Choose N such that $E_S \le 5 \cdot 10^{-10}$.
Hint: evaluate $M_4 = \max\limits_{x\in[1,2]} \left|\frac{d^4}{dx^4}\cos(\sqrt{3}\,x)\right|$. 2%

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2 Evaluate the indefinite integral $\displaystyle\int \sin^5 x\; dx$. 3%

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3 Find the average value of the function $\dfrac{x+6}{x^2+4x+4}$ on the interval $[-1, 2]$. 4%

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4 Evaluate the indefinite integral $\displaystyle\int e^x \sin(x/2)\; dx$. (Hint: use integration by parts.) 4%

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5 Perform a partial fraction expansion of $\dfrac{4}{(x^2-1)(x^2+1)}$;

then *evaluate the indefinite integral* $\displaystyle\int \frac{4}{(x^2-1)(x^2+1)}\,dx$. 5%

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