MID-SEMESTER ASSESSMENT PAPER

MODULE CODE: MA4002	SEMESTER: Spring 2018
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 $\displaystyle\int \frac{x^4}{\sqrt{x^5+7}}\,dx$.
Hint: use an appropriate substitution. 2%

(b) Calculate the area between $y = 2^x - \dfrac{1}{(x+1)^2}$ 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 $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\left(x_i^2+\sin(x_i^3)\right)\triangle x$, where we use the partition P with $x_i = -2 + \dfrac{4i}{n}$ for $i = 0, 1, \ldots, n$ and $\triangle x \equiv x_i - x_{i-1}$. 2%

(d) Evaluate $\dfrac{d}{dx}\left(\displaystyle\int_{x^2+1}^{x+11} \ln(t+\sin t)\;dt\right)$. 1%

(e) Find an upper bound for the error E_S in the Simpson's Rule approximation of the definite integral $\displaystyle\int_0^9 \exp(-10x)\,dx$, using N subintervals. Evaluate $M_4 = \max\limits_{x\in[0,9]}\left|\frac{d^4}{dx^4}\exp(-10x)\right|$. Then choose N such that $E_S \le 5\cdot 10^{-2}$. 2%

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

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3 Find the average value of the function $\dfrac{x-5}{x^2+4x+3}$ on the interval $[2,4]$. 4%

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

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

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

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