Menofia University Faculty of Engineering Shebien El-kom Production Engineering and Mechanical Design Departement First Year Examination, 2015-2016 Date of Exam : 28 / 01 / 2016	Minoufia University	Subject: Engineering Mathematics (2) Code: BES 113 Time Allowed : 3 hrs Total Marks: 90 Marks

Answer all the following questions الامتحان في صفحتان

Question 1 [25 Marks (A 8 Marks, B 8 Marks, and C 9 Marks)]

(A) Find the general solution of the following first order first degree ordinary differential equations:

$$1-(tanx\ sin^2y)dx+(cos^2x\ coty)dy=0 \qquad 2-\frac{dy}{dx}=\frac{x+2y-3}{2x+y-3}$$

(B) Find the general solution of the following the first order first degree ordinary differential equations:

$$1-(y\ sin2x)dx+(y^2+cos^2x)dy=0 \qquad 2-\frac{dy}{dx}+\frac{2y}{x}=sinx$$

(C) Find the general solution of the following ordinary differential equations:

$$1\text{-}\left(\frac{dy}{dx}\right)^3-e^{2x}\frac{dy}{dx}=0 \qquad 2\text{-}\ (x^2-1)\frac{d^2y}{dx^2}+x\frac{dy}{dx}=0$$

Question 2 [25 Marks (A 5 Marks, B 10 Marks, C 5 Marks, and D 5 Marks)]

(A) Find the general solution of the homogenous system of differential equations:

$$\frac{d^2x}{dt^2}-y=0 \qquad \text{and} \qquad \frac{d^2y}{dt^2}-x=0$$

(B) Find the total solution of the following non-homogenous differential equation by the linear differential operator method

$$1-\frac{d^3y}{dx^3}-\frac{dy}{dx}=cos^2(x) \qquad 2-\frac{d^2y}{dx^2}+16\,y=e^{5x}+x^2+32$$

(C) Evaluate the double integral $\iint_D (x^2+y^2)\,dx\,dy$ where D is the triangle bounded by the lines $x=5$, $y=x$, and $y=0$

(D) Evaluate the triple integral $\iiint_D (2x-y-z)\,dx\,dy\,dz$

where $D=\{(x,y,z):0\le x\le 1,\ 0\le y\le x^2,\ 0\le z\le x+y\}$

Question 3 [18 Marks (A 6 Marks, B 6 Marks, and C 6 Marks)]

(A) Find the Laplace Transform of the following functions:

$1-f(t)=2\,e^{2t}\,cos^2(t)$ $\quad$ $2-f(t)=t^2\,sin(2t)$ $\quad$ $3-\;f(t)=\int_0^t \frac{1-cost}{t}dt$

(B) Find the inverse Laplace Transform of the following functions:

$1-F(s)=\frac{6s-4}{s^2-4s+20}$ $\quad$ $2-\;F(s)=ln\left(\frac{s^2+1}{s-2}\right)$ $\quad$ 3- $F(s)=\frac{1-e^{-2s}}{s^2+16}$

(C) Solve the initial value problem using the Laplace transform method

$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^{-t}\sin(t)$ with the initial conditions

$$y(0)=0,\frac{dy}{dt}(0)=1\,.$$

Question 4 [22 Marks (A 8 Marks, B 6 Marks, and C 8 Marks)]

(A) Test the convergence of the following infinite series:

$1-\;s_n=\sum_{n=1}^{n=\infty}\frac{4n^2-n-3}{n^3+2n}$ $\quad$ $2-\;s_n=\sum_{n=1}^{n=\infty}\frac{n\,!}{10^n}$

$3-\;s_n=\sum_{n=1}^{n=\infty} n\,e^{n^2}$ $(use\ the\ integral\ test)$ $\quad$ $4-\;s_n=\sum_{n=0}^{n=\infty}\frac{(-1)^{n+1}}{n^3}$

(B) Find the interval and the radius of convergence of the following infinite series:

$1-\;s_n=\sum_{n=1}^{n=\infty}\frac{x^{n-1}}{(n-1)\,!}$ $\quad$ $2-\;s_n=\sum_{n=1}^{n=\infty}(x-15)\,n\,!$

$$3-\;s_n=\sum_{n=1}^{n=\infty}\frac{(x-5)^{\,n}}{n}$$

(C) Find the Fourier series of the function:

$$f(x)=\begin{cases}1 & -\pi\le x\le 0\\ x & 0\le x\le \pi\end{cases}$$

Then, show that: $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots$

With my best wishes $\qquad$ *Dr. Mohamady Bassioni*