Menoufia University **Faculty of Engineering, Shebin El-Kom,** **Civil Engineering Department** **First Semester Examination, 2014-2015** **Date of Exam: 14/1/2016**	**Subject: Math (2).** **Code :BES 114** **Year : 1st year** **Time Allowed : 3 hours** **Total Marks: 100 marks**

Answer the following questions

Question 1 :

(a) Solve the initial value problem by using Laplace transform:

$$y'' + \lambda^2 y = \cos \lambda t \qquad y(0)=1,\ y(\frac{\pi}{2\lambda})=1$$

Also solve this problem , if the boundary is given as $y(0)=1,\ y'(\frac{\pi}{\lambda})=1$

(b) Draw and compute the Fourier series of the function:

$$f(t)=\begin{cases} t & 0<x<1 \\ 1-t & 1<x<2 \end{cases}$$

(c) Test the convergence of the following series:

$$i)\ \sum_{n=1}^{\infty}\frac{n(x-1)^n}{2^n(3n-1)} \qquad ii)\ \sum_{n=1}^{\infty}\frac{e^{\tan^{-1}n}}{n^2+1}$$

(d) Evaluate the following integrals :

$i)$ $\iint_D \frac{1}{x}\cos\frac{y}{x}dA$ where $D=\left\{(x,y)\,\middle|\,\frac{\pi}{2}\le x\le\pi,\ 0\le y\le x^2\right\}$

$ii)$ $\iiint_D (xz+yz)dV$ where $D=\{(x,y,z)\,|\,0\le x\le 2,\ 0\le y\le 3,\ 0\le z\le -x+4\}$

(e) Find the Laplace transform of the functions:

$$i)\ f(t)=(e^{-2t}-1)^2\sin^2 t+u(t-2)\cosh 2(t-2) \qquad ii)\ f(t)=e^{2t}\frac{\cos 3t}{t}$$

(f) Find the mass and center of mass of the lamina that occupies the region D bounded by the curves $y=x^2$, $x=y^2$ and has density function $\rho(x,y)=\sqrt{x}$.

Question 2

(a) Find the inverse Laplace transform of the functions:

$$i)\ F(s)=\frac{2s^2}{(s^2+1)(s-1)^2} \qquad ii)\ F(s)=\frac{1}{2}\ln\left(1+\frac{4}{s^2}\right)$$

(b) Find the inverse Laplace transform by using the convolution theorem

$$F(s)=\frac{1}{s^2\left(s^2+1\right)}$$

(c) Graph the function and then find its Laplace transform

$$f(t)=\begin{cases}\sin t & 0<t<\pi\\ 0 & \pi<t<2\pi\end{cases}$$

(d) Find the orthogonal trajectories of the following curve:

$$x^2+y^2+2fy+1=0, \qquad \text{where } f \text{ is the parameter}$$

(e) Solve the following ordinary differential equations:

$$i)\ (D^2+2D+2)=2e^{-x}\sin x \qquad ii)\ (x^2-1)\frac{d^2y}{dx^2}+x\frac{dy}{dx}=0$$

$$iii)\ \frac{dx}{dy}+\frac{x}{1+y^2}=\frac{e^{\tan^{-1}y}}{1+y^2} \qquad iv)\ y=2px+y^2p^3$$

$$v)\ 3e^x\tan y+(1-e^x)\sec^2 x\frac{dy}{dx}=0 \qquad vi)\ x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$$

(f) Solve the system of simultaneous differential equations:-

$$\frac{dx}{dt}+7x-y=e^{-t}$$

$$\frac{dy}{dt}+2x+5y=0$$

With my best wishes **Dr. Eng. Rizk Masoud**

This exam measures the following ILOs													
Question Number	Q 1-a	Q 1-a	Q 1-b	Q 5-c	Q4-c	Q5-b				Q3-b	Q 5-a		
	Q 2-a	Q 2-b	Q 2-c	Q3-c	Q3-a	Q4-b				Q4-a			
Skills	Knowledge & understanding Skills				Intellectual Skills					Professional Skills			