Menoufia University Faculty of Engineering, Shebin El-Kom, Electrical Engineering Department First Semester Examination, 2013-2014 Date of Exam: 1/1/2014	Subject: Eng. Maths. Code : BES 111 Year : 1st year Time Allowed : 3 hours Total Marks: 140 marks

Answer the following questions

Question 1

(30 marks)

a) Solve the following differential equations: (10 marks)

i) $\cos x \frac{dy}{dx} + y \sin x = 2x \cos^2 x$ *ii)* $y'' = e^{2x} + 3x$

b) Test the convergence of the following series: (10 marks)

i) $\sum n^2 e^{-n^3}$ *ii)* $\sum \frac{3n^3 - 2n^2 + 4}{n^7 - n^3 + 2}$

c) Draw and compute the Fourier series of the function: (10 marks)

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

Question 2

(25 marks)

a) Solve the initial value problem by using Laplace transform: (10 marks)

$y'' + 2y' - 3y = 6\, e^{-2t}$ $y(0) = 2,\ y'(0) = -14$

b) Find the interval of convergence : $\sum \frac{(2x-3)^n}{4^{2n}}$ (5 marks)

c) Find the Laplace transform of the functions: (10 marks)

i) $f(t) = (t+1)^2 e^{-3t}$ *ii)* $u(t-5)\, e^{2(t-5)} \cosh(t-5)$

Question 3

(30 marks)

a) Find the moments of inertia I_x, I_y, I_0 for the lamina that occupies the region D , where D is bounded by

$y = e^x,\ y = 0,\ x = 0,\ and\ x = 1\ ;\ \rho(x,y) = y$ (10 marks)

b) Find the orthogonal trajectories of the curve: $y^2 = C x^3$ (10 marks)

c) Find the inverse Laplace transform of the functions: (10 marks)

i) $\frac{1 + e^{-2s}}{s^2 - 9}$ *ii)* $\ln \frac{(s-1)^2}{s^2 + 1}$

Question 4

(30 marks)

a) Solve the system of simultaneous differential equations: (10 marks)

$$\frac{d^2x}{dt^2}+\frac{dy}{dt}=e^{-t} \quad , \quad \frac{d^2y}{dt^2}-2\frac{dx}{dt}=\cos 4t$$

b) Evaluate the triple integral $\iiint_D z\, e^{y}\, dx\, dz\, dy$ where D is given by (10 marks)

$D:\ 0 \le x \le \sqrt{1-z^2}, \quad 0 \le y \le 3, \quad 0 \le z \le 1$

c) Solve the differential equation: $(x^2D^3+4xD^2-5D-\frac{15}{x})y=\frac{1}{x^3}$ (10 marks)

Question 5

(25 marks)

a) Solve the ordinary differential equations: (10 marks)

i) $(\frac{3y^2}{x^2+3x})dx+(2y\ln\frac{x}{x+3}+3\sin y)dy=0$ *ii)* $p^2-2xp-8x^2=0$

b) Use the definition of the Laplace transform to obtain the Laplace transformation for function: $f(t)=\sin at$ (5 marks)

c) Find the solution of the initial value problem: (10 marks)

$$\frac{d^2x}{dt^2}-16x=32 \qquad x=0,\ \frac{dx}{dt}=2 \quad when \quad t=0$$

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