ﺑﺴﻢ

Menofia University Faculty of Engineering Shebin El-kom Production Engineering and Mechanical Design Department First Year Examination, 2018-2019	Minoufia University	Subject: Engineering Mathematics (2) Code: BES 113 Time Allowed : 3 hrs Total Marks: 100 Marks Date of Exam : 14 / 01 / 2019

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 thefollowing first order first degree ordinary differential equation

$$1)\ x^2y^2\,\frac{dy}{dx} = (1+x)\ cosec\ 2y \qquad 2)\ \frac{dy}{dx} = \frac{2xy+3y^2}{x^2+2xy}$$

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

$$1)\ (x+y^2 sinx - y^3)dx = (3xy^2 + 2y\ cosx)dy \qquad 2)\ x\frac{dy}{dx} + 3y = \frac{sin2x}{x}$$

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

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

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

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

$$\frac{d^2x}{dt^2} - 3x - 4y = 0 \text{ and } \frac{d^2y}{dt^2} + x + y = 0$$

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

$$1)\ \frac{d^3y}{dx^3} - \frac{dy}{dx} = (e^x+1)^2 \qquad 2)\ \frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = cos3x + x + 10$$

(C) Evaluate the double integral $\iint_D (x+y+1)dx\,dy$ where D is the domain bounded by the curves $y=-x$, $y=x^2$, $and\ y=2$

(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 [25 Marks (A 9 Marks, B 9 Marks, and C 7 Marks)]

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

1) $f(t) = \dfrac{sinh3t}{e^{-t}} + t^3 + sin^2(t)$ 2) $f(t) = t^2\, sin(3t+1)$ 3) $f(t) = \int_0^t \dfrac{1 - cost}{t} dt$

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

1) $F(s) = \dfrac{6s-4}{s^2-4s+20}$ 2) $F(s) = ln\left(\dfrac{s+1}{s-1}\right)$ 3) $F(s) = \dfrac{1-e^{-2s}}{s^2+25}$

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

$\dfrac{d^2y}{dt^2} - 3\dfrac{dy}{dt} + 2y = 6\, e^{-t}$ with the initial conditions

$$y(o) = \frac{dy}{dt}(0) = 3 .$$

Question 4 [25 Marks (A 8 Marks, B 9 Marks, and C 8 Marks)]

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

1) $s_n = \sum_{n=1}^{n=\infty} \dfrac{n}{n^3+2}$ 2) $s_n = \sum_{n=1}^{n=\infty} \dfrac{2^n}{n^3}$

3) $s_n = \sum_{n=1}^{n=\infty} \dfrac{1}{(n+1)ln(n+1)}$ 4) $s_n = \sum_{n=1}^{n=\infty} (-1)^{n-1}\dfrac{n+1}{n}$

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

1) $s_n = \sum_{n=1}^{n=\infty} \dfrac{x^{n-1}}{(n-1)\,!}$ 2) $s_n = \sum_{n=1}^{n=\infty} \dfrac{(n+1)x^n}{n!}$

3) $s_n = \sum_{n=1}^{n=\infty} \dfrac{(x-2)^n}{n}$

(C) Graph the function and then find the Fourier series of the function:

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

With my best wishes *Dr. MohamadyBassioni*