| Department of Energy and Sustainable Energy<br>Answer **All** questions Duration: 45 Minutes | Mathematics IV Mid-Term Exam 1<br>March 30, 2015 15 Marks |
|---|---|

[1] Prove that: If D is the differential operator with respect to x, F(D) is a polynomial of D, f(x) is differentiable function and k is constant. Then

$$F(D)\left[f(x)e^{kx}\right] = e^{kx}F(D+k)f(x)$$

[2]Solve the following equations:

(a) $xy\,dx + (3+y)dy = 0$

(b) $(y + xe^{y})dy + (x + e^{y})dx = 0$

(c) $y` + \frac{1}{x}y = \frac{2}{x^2}$

(d) $(D^2 - 3D - 4)y = e^{x} + e^{4x}$

(e) $(D^2 + 4)y = (\sin x + \cos x)^2$

(f) $(x^2D^2 - xD + 2)y = \ln x$

*Good Luck* *Dr. Mohamed Eid*

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*Good Luck* *Dr. Mohamed Eid*

| Department of Energy and Sustainable Energy<br>Answer **All** questions Duration: 50 Minutes | Mathematics IV Mid-Term Exam 2<br>March 30, 2015 10 Marks |
|---|---|

[1] Prove that: If f(t) is function with Laplace transformation F(s). Then

$$L\left\{\int_0^t f(t)\,dt\right\} = \frac{1}{s}F(s)$$

[2]Find Laplace transformation of the following:

(a) $f(t) = t + \sin 3t$ (b) $f(t) = \sinh t + e^t \cos 2t$ (c) $f(t) = (t + 2^t)^2$

(d) $f(t) = (t-2)^8, \quad t > 2$ (e) $f(t) = (\sin t + \cos t)^2$ (f) $f(t) = \frac{\sin 2t}{t}$

[3]Find the integral: $\int_0^\infty \frac{\cos t - \cos 3t}{t}\,dt$

(b)Find the inverse Laplace transform of: (i) $F(s) = \frac{s-4}{S^2+4}$ (ii) $F(s) = \frac{s+3}{S^2-3s+2}$

*Good Luck* *Dr. Mohamed Eid*


| Department of Energy and Sustainable Energy<br>Answer **All** questions Duration: 50 Minutes | Mathematics IV Mid-Term Exam 2<br>March 30, 2015 10 Marks |
|---|---|

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*Good Luck* *Dr. Mohamed Eid*

| Benha University<br>Faculty of Engineering – Shoubra<br>Department of Energy and Sustainable Energy<br>Course: Mathematics 4 Code: EMP 202 | Final Exam<br>Date: June 10, 2015<br>Duration: 3 hours<br>Answer **All** questions |
|---|---|
| • The exam consists of one page | • No. of questions: 4 Total Mark: 40 |

## Question 1

Solve the following equations: **9**

(a) $y\sin x\ dx + (1+y^2)dy = 0$

(b) $(y + x\cos y)dy + (x + \sin y)dx = 0$

(c) $y`` - 2y` - 3y = e^{-x} + 3^x$

(d) $y`` + y` = 3 + x^2$

(e) $(D^2+4)y = 1 + \cos 2x$

(f) $(D^2+1)y = \tan x$

## Question 2

(a)Prove that: If f(t) is function with Laplace transformation F(s). Then **2**

$$L\left\{\frac{f(t)}{t}\right\} = \int_s^\infty F(s)\,ds$$

(b)Find Laplace transformation of the following: **4**

(i) $f(t) = 3 + t^3 + \sinh 3t$

(ii) $f(t) = \sin 3t + t\cos t$

(iii) $f(t) = \sin(t-3)\,,\ t > 3$

(iv) $f(t) = \frac{e^{3t}-e^{2t}}{t}$

(c)Find the inverse Laplace transform of: (i) $F(s) = \frac{s}{s^2-2s-3}$ (ii) $F(s) = \tan^{-1}(s-2)$ **2**

(d)Solve the equation: $y`` + 2y` + y = e^{-t}$, $y(0) = 0$, $y`(0) = 1$. **3**

## Question 3

**10**

(a)Find the root of the equation $x^3 + 3x - 10 = 0$ by usingNewton method.

(b)Construct the difference table to the following data.

Hence find interpolation polynomial interpolate the function y = f(x)

at the points (0, 1), (0.1, 1.32), (0.2, 1.68), (0.3, 2.08), (0.4, 2.52).

## Question 4

**10**

(a)Approximate the integrals $\int_0^1 \sqrt{1+x}\,dx$ using Sampson's rule. Estimate the error

by computing the exact value.

(b)Solve the differential equation : $y' = x + y$, $0 < x < 1$, $y(0) = 1$

using Euler method considering $h = 0.2$. Estimate the error at $x = 0.4$ by comparing your result.

*Good Luck* *Dr. Mohamed Eid* *Dr. Fathi Abdsallam*