Benha University
Faculty of Engineering – Shoubra
Electrical Engineering Department

كلية الهندسة بشبرا

Engineering Mathematics (1) A
Final Exam **31/12/2017**
Time allowed: **3 hour**

First year Power Branch

(Total Mark (100) 20 for each question)

Answer the following questions:

Question (1)

(a) Test the series $\sum_{n=1}^{\infty} \frac{3n+1}{2^n}$ for convergence and find the interval of convergence

for the power series $\sum_{n=1}^{\infty} \frac{(x+3)^n}{n.2^n}$

(b) Given $w = \tan^{-1}(x^3 + y^3)$ show that $x\frac{\partial w}{\partial x} + y\frac{\partial w}{\partial y} = 3\sin w \cos w$

(c) Find the local extrema of the function $f(x, y) = -x^2 - 4x - y^2 + 2y - 1$.

Question (2)

(a) For any scalar function $\varphi(x, y, z)$ show that $\textbf{curl grad}\boldsymbol{\varphi} = 0$

(b) Find the area enclosed by the curve $x^{2/3} + y^{2/3} = a^{2/3}$.

(c) Find the area bounded by the curves $xy = 4, xy = 8, xy^3 = 5, xy^3 = 15$

Question (3)

Solve the following differential equations

(a) $(xy - x^2)dy - y^2dx = 0$

(b) $(xy^3 - 1)dx - x^2y^2dy = 0$

(c) $y'' - 6y' + 13y = 8e^{3x}\sin 2x$

Question (4)

(a) Find the general solution for Euler equation $x^2y'' - xy' + 2y = x\ln x$

(b) Use variation of parameter to solve $y'' + n^2y = \sec nx$.

(c) Solve $xy'' - (2x + 1)y' + (x + 1)y = 0$ given that $y = e^x$ one solution.

إنتبه : السؤال الخامس فى ظهر ورقة الأسئلة

Question (5)

(a) For the vector field $\vec{F} = (4xy - 3x^2z^2)\vec{i} + 2x^2\vec{j} - 2x^3z\,\vec{k}$ prove that

$\oint_C \vec{F}.d\vec{r}$ independent to any path through two any points in domain $\vec{F}$ and find

the scalar potential function φ which satisfy $\vec{F} = \vec{\nabla}\varphi$.

(b) Evaluate $\oiint_S \vec{F}.\vec{n}\,ds$ where $\vec{F} = 2yx\,\vec{i} + y\,z^2\,\vec{j} + xz\,\vec{k}$ and S is the surface of

parallelogram bounded by $x = 0,\ y = 0,\ z = 0\ \ x = 2,\ y = 1,\ z = 3$

(c) Apply Stock and Green theorem to evaluate $\iint_S (\overline{\nabla} \times \overline{F}).\overline{n}\,dS$ where

$\vec{F} = (x^2 + y - 4)\vec{i} + (3xy)\vec{j} + (2xz + z^2)\vec{k}$ and S is the surface bounded by the

paraboloid $z = 4 - (x^2 + y^2),\ z \geq 0$.

Dr. Fathi Abdessalam