Menoufiya University		Subject: Math.(3) Code: BES213
Faculty of Engineering Shebin El-Kom		Time Allowed: 3 hours
Des. & Prod. Eng. Department		Total Marks: 100 marks
First Semester Examination 2013-2014		Date of Exam: 12/1/2014

Solve the Following Questions

(Question Number-1) :(20 Marks)

(A) Let f be a scalar field and $\bar{F}$ be a vector field. Check the appropriate box (Vector, Scalar, or Nonsense) for each quantity.

	Quantity	Vector	Scalar	Nonsense		Quantity	Vector	Scalar	Nonsense
1	$\nabla\cdot(\nabla f)$	☐	☐	☐	5	$\mathbf{curl}(\nabla f)$	☐	☐	☐
2	$\mathbf{grad}(\mathbf{div} f)$	☐	☐	☐	6	$\nabla\cdot(\nabla\times\bar{F})$	☐	☐	☐
3	$\mathbf{div}(\mathbf{grad}\,\bar{F})$	☐	☐	☐	7	$\mathbf{div}(\mathbf{curl} f)$	☐	☐	☐
4	$\mathbf{div}(\mathbf{div}\,\bar{F})$	☐	☐	☐	8	$\mathbf{curl}(\mathbf{curl}\,\bar{F})$	☐	☐	☐

(B) Prove that $\iint_S \bar{r}\cdot\bar{n}ds = 3$; S is the surface of the cube bounded by x=0, x=1, y=0, y=1, z=0, z=1.

(C) Show that the area bounded by a simple closed curve C is given by $\frac{1}{2}\oint_C xdy - ydx$.

(Question Number-2) :(20 Marks)

(A) If $\bar{U}(x,y,z) = (2x^2z)\bar{i} - (xy^2z)\bar{j} + 3yz^2\bar{k}$. State whether: 1 $\bar{U}$ is irrotational or not? 2 $\bar{U}$ is solenoidal or not? 3 $\mathbf{div}\,\bar{U}$ is harmonic function or not?

(B) If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$. 1 Find $grad\phi$ if $\phi = \ln r$, 2 Find $\nabla\phi$ if $\phi = \frac{1}{r}$

(Question Number-3) :(20 Marks)

(A) Verify Green's theorem in the plane for $\oint_C (x^2y + y)dx + y^2dy$ where C is the closed curve between the two curves $y = x$, $y = x^2$.

(B) Verify stokes' theorem for $\bar{F} = (yz)\bar{i} + (xz)\bar{j} + xy\bar{k}$; S is the surface of the cube $x=0$, $y=0$, $z=0$, $x=1$, $y=1$, $z=1$ above y-z plane.

(Question Number-4) :(20 Marks)

(A) Prove that the area of a parallelogram with sides $\bar{A}$ and $\bar{B}$ is $|\bar{A}\times\bar{B}|$.

(B) Solve the following problem by the simplex method:

$$\begin{aligned} \text{Max} \quad & z = 4x_1 + 5x_2 \\ s.t. \quad & 5x_1 + 4x_2 \le 200 \\ & 3x_1 + 6x_2 = 180 \\ & 8x_1 + 5x_2 \ge 160 \\ & x_1,\ x_2 \ge 0 \end{aligned}$$

(Question Number-5) :(20 Marks)

(A) Evaluate the following integrals 1 $\int_0^\infty y^{\frac{1}{2}} e^{-y^3} dy$ 2 $\int_0^2 \frac{x^2}{\sqrt{2-x}} dy$

(B) Prove that $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} (\sin\theta)^{2m-1}(\cos\theta)^{2n-1} d\theta$, and evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\tan\theta}\, d\theta$

WITH OUR BEST WISHES ***DR. MOHAMMED A. EL-SHORBAGY***

This exam contributes " by measuring in achieving Programme Academic Standards according to NARS

Question Number	Q1-A	Q1-B,C	Q2, Q4-A	Q3	Q4-B		Q5
Skills	a-1-1, a-1-2, a-1-3	a-8-1	a-1-3	b-3-1	b-7-1		c-1-1
	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills