King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 301 Major Exam II
Thursday, November 29, 2011
10:00-12:00

NAME:.....ID:.....

Exercise #1: (16 pts) Verify the divergence theorem for the vector field

$$F = 2xz\mathbf{i}+yz\mathbf{j}+z^2\mathbf{k}$$

and V is the volume enclosed by the upper hemisphere

$$x^2 + y^2 + z^2 = 4, z > 0.$$

Exercise #2: (16 pts) Verify Stokes' theorem for the vector field

$$F = (2x - y)\mathbf{i} - yz^2\mathbf{j} - y^2z\mathbf{k}$$

and S the upper half of the sphere

$$x^2 + y^2 + z^2 = 1$$

and $\mathcal{C}$ its boundary.

Exercise #3: (8 pts) Show that the given functions are orthogonal on the indicated interval,

$$f(x) = x^3 \ , \ g(x) = x^2 + 5 \ , \ [-1, 1]$$

and normalize them.

Exercise #4: (5 pts) Show that the given functions are orthogonal with respect to the indicated weight on the given interval,

$$f(x) = 1 \ , \ g(x) = 1 - x \ , \ w(x) = \mathbf{e}^{-x} \ , \ [0, \infty)$$

Exercise #5: (15 pts) Find the Fourier series of f given by,

$$f(x) = \begin{cases} 2, & -1 < x < 0 \\ x, & 0 \leq x < 2 \end{cases}$$

Exercise #6 (15 pts) : Find the Fourier Sine series of f given by,

$$f(x) = x, \ \ 0 \leq x < \pi$$

Exercise #7: (15 pts) Find the Fourier Cosine series of f given by,

$$f(x) = x, \ \ 0 \leq x < \pi$$

Exercise #8: (10 pts) Let the function f be given by

$$f(x) = x^2, \ \ 0 \leq x < \pi$$

Plot the graph of f and the graphs of its Fourier series, its Fourier Sine series and its Fourier Cosine series.