The Open University of Sri Lanka
Department of Electrical and Computer Engineering
ECX 5241 – Distributed Parameter Systems
Final Examination – 2012/2013

Date: 2013-08-04 Time: 0930-1230

The paper contains two sections A and B. Answer **four** questions by answering **all in section A** and **one question from section B.**

Section A

Answer all questions in this section. (20 Marks for each)

1. (a) Compare terms "Distributed parameter systems" and "Lumped parameter systems"

(b) Choose any physical system and explain how it can be modeled as a distributed parameter system.

(c) Starting from the general form of PDE, explain how the second order partial differential equations are classified as hyperbolic, parabolic and elliptic equations.

2. (a) Explain what is an irrotational vector field?

(b) Show that

(i) $\nabla \cdot (\nabla\phi \times \nabla\psi) = 0$ and

(ii) $\nabla \times (\phi \boldsymbol{a}) = \nabla\phi \times \boldsymbol{a} + \phi\nabla \times \boldsymbol{a}$ where ϕ and ψ are scalar fields and $\boldsymbol{a}$ is a vector.

(c) Compute the flux of water through the parabolic cylinder $S: y = x^2$, $0 \le x \le 2$ and $0 \le z \le 3$. The velocity of the water vector $\boldsymbol{v} = [3z^2, 6, 6xz]$. (Generally $\boldsymbol{F} = \rho\boldsymbol{v}$, but water has the density $\rho = 1\ g/cm^2$)

3. (a) What are the differences between **Finite Element Method** and **Finite Difference Method**?

(b) What are the disadvantages of Finite Element Method?

(c) The 'pdetool' in Matlab(R) is used to solve PDEs using Finite Element Method. State the steps that you have to follow in solving PDEs. (No need to explain Matlab(R) menu options).

Section B

Select one questions from this section. You may start with the general solution of the PDE. (40 Marks)

4. A string of length L is fastened at both ends A and C. At a distance b from the end A the string is transversely displaced to a distance d from rest when it is in this position. Find the equation of the subsequent motion.

5. Find the temperature of a thin metal rod of length L, with both ends insulated and with initial temperature of the rod at a distance x is $sin\ (^{\pi x}/_{L})$.