**Midterm**

**Variant 1.**

1. Give the classification of the equation .

2. Using the Fourier method, solve the boundary problem

*utt =* 4 *uxx* + cos *x*, 0 < *x* < π, *t* > 0.

*u*(*x*,0) = 0, *ut*(*x*,0) = 0, *ux*(0,*t*) = 0, *ux*(*π*,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 2.**

1. Give the classification of the equation .

2. Using the Fourier method, solve the boundary problem

*utt =* 2 *uxx* – sin π*x*, 0 < *x* <1, *t* > 0.

*u*(*x*,0) = 0, *ut*(*x*,0) = 0, *ux*(0,*t*) = 0, *ux*(1,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 3.**

1. Determine the characteristics of the equation .

2. Using the method of separation of variables, solve the boundary problem

*utt =* 2 *uxx*, 0 < *x* <1, *t* > 0.

*u*(*x*,0) = 0, *ut*(*x*,0) = – sin π*x*, *u*(0,*t*) = 0, *u*(1,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 4.**

1. Determine the characteristics of the equation .

2. Using the method of separation of variables, solve the boundary problem

*utt =* 4 *uxx*, 0 < *x* <π, *t* > 0.

*u*(*x*,0) = -cos *x*, *ut*(*x*,0) = 0, *ux*(0,*t*) = 0, *ux*(π,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 5.**

1. Formulate the first boundary problem for the non-homogeneous vibrating string equations.

2. Using the method of separation of variables, solve the boundary problem

*utt =* 4 *uxx*, 0 < *x* <1, *t* > 0.

*u*(*x*,0) = 0, *ut*(*x*,0) = cos 2π*x*, *ux*(0,*t*) = 0, *ux*(1,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 6.**

1. Formulate the second boundary problem for the homogeneous vibrating string equations.

2. Using the method of separation of variables, solve the boundary problem

*utt =* 4 *uxx*, 0 < *x* <π, *t* > 0.

*u*(*x*,0) = – sin 2π*x*, *ut*(*x*,0) =, *u*(0,*t*) = 0, *u*(1,*t*) = 0, *t* > 0.

Check that this is, in reality, the solution of the boundary problem. Show the graph. Give the physical interpretation of the results.

**Variant 7.**

1. Give the classification of the equation .

2. Using the D'Alembert formula, solve the problem

*utt = uxx* , -∞ < *x* < ∞, *t* > 0; *u*(*x*,0) = *ϕ*(*x*), *ut*(*x*,0) = 0,

where the function *ϕ* is determined by the graph



Check that this is, in reality, the solution of the problem. Show the graph. Give the physical interpretation of the results.

**Variant 8.**

1. Determine the characteristics of the equation .

2. Using the D'Alembert formula, solve the problem

*utt = uxx* , -∞ < *x* < ∞, *t* > 0; *u*(*x*,0) = *ϕ*(*x*), *ut*(*x*,0) = 0,

where the function *ϕ* is determined by the graph



Check that this is, in reality, the solution of the problem. Show the graph. Give the physical interpretation of the results.