SRM Institute of Science and Technology
College of Engineering and Technology
Department of Mathematics
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu
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Course Code &Title: 18MAB201T-Transforms and Boundary Value Problems

Year &Sem: II/III

Tutorial 1

Part A

Q. No	Questions
1	Classify the PDE $$5u_{xx} - 3u_{yy} + \cos x\ u_x + e^y u_y + u = 0$$
2	Classify the equation into hyperbolic, elliptic or parabolic type. $$x\,u_{xx} + (x-y)u_{xy} - yu_{yy} = 0$$
3	Verify $u(x,t) = -x^2 - (t-1)^2$ is a solution of the wave equation $$u_{tt} = u_{xx}, \quad -1 < x < 1, t > 0$$ $$u(x,0) = -x^2 - 1,\ u_t(x,0) = 2,$$ $$u(-1,t) = u(1,t) = -t^2 + 2t - 2.$$
4.	Reduce two ODEs by the method of separation of variables from the PDE given below: $$au_{xt} + bu = 0,$$ where a and b are constants.
5.	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set to vibrate by giving each point a velocity v_0. Write down the corresponding partial differential equation, initial and boundary conditions.

Part B

6.	Derive all the possible solutions for the one-dimensional wave equation using separation of variable method.
7.	Solve the wave equation: $$u_{tt} = 4u_{xx}, \quad 0 < x < \pi, t > 0,$$ $$u(0,t) = 0 = u(\pi,t), \quad t \geq 0,$$ $$u(x,0) = \sin x - 2\sin 3x, \quad u_t(x,0) = 0, \quad 0 \leq x \leq \pi.$$ Hence find $u\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$.
8.	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $y(x,0) = y_0 \sin\frac{2\pi x}{l}$. If it is released from rest from this position, find the displacement y at any distance x from one end at any time t.
9.	Solve the wave equation: $$u_{tt} = 9u_{xx}, \quad 0 < x < 1, t > 0,$$ $$u(0,t) = 0 = u(1,t), \quad t \geq 0,$$ $$u(x,0) = x(1-x), \quad u_t(x,0) = 0, \quad 0 \leq x \leq 1.$$
10.	A taut string of length $2l$ is fastened at both ends. The mid point of the string is taken to a height b and then released from rest in that position. Find the displacement function.