



INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA612L-PARTIAL DIFFERENTIAL EQUATIONS

Exercise Questions

First order Quasilinear PDE

1. Solve $au_x + bu_y + cu - d = 0$ with a, b, c, d constants

2. Find the solution of the following Cauchy problems

$$xu_x + yyu_y = 2xy, \text{ with } u = 2 \text{ on } y = x^2$$

3. Find the solution of the following Cauchy problems

$$uu_x - uu_y = u^2 + (x + y)^2, \text{ with } u = 1 \text{ on } y = 0$$

4. Solve

$$uu_x + u_y = 2, u(x, x) = x/2$$

5. Find the general solution of the PDE

$$y^2u_x - xyu_y = x(u - 2y)$$

6. Solve the IVP

$$xu_x + yu_y = u + 1, \text{ with } u = x^2 \text{ on } y = x^2$$

7. Solve the IVP

$$u_x + xu_y = u, u(1, y) = h(y)$$

8. Solve the IVP

$$u_t + uu_y = u, u(x, 0) = \phi(x)$$

9. Solve the IVP

$$u_t + au_x = u^2, u(x, 0) = \cos x$$

10. Find general solution of

$$yu_y - xu_x = 2$$

11. Solve the following equation using the method of characteristics

$$xu_x + tu_t = -u$$

12. Solve the following equation using the method of characteristics

$$tu_x - xu_t = u$$

13. Show the following IVP has no solution

$$u_t + u_x = 0 \text{ with } u = x \text{ on } x^2 + t^2 = 1$$

14. Show the following IVP has no solution for any arbitrary function $f(x)$

$$(t - x)u_x - (t + x)u_t = 0 \text{ with } u(x, 0) = f(x)$$

15. Show the following IVP has no solution

$$u_t + u_x = x \text{ with } u(x, x) = 1$$

16. Solve the IVP

$$u_t + uu_x = x, u(x, 0) = f(x)$$

for $f(x) = 1$ and $f(x) = x$

17. Analyze the solution of the IVP

$$u_t - u^2 u_x + cu = 0, u(x, 0) = g(x)$$

18. Solve the Burgers equation

$$u_t + uu_x = 0, u(x, 0) = 1 - x^2$$