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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JULY 2017

Second Semester

Faculty of Science

Branch 1—(A) Mathematics

MT 02 C09—PARTIAL DIFFERENTIAL EQUATIONS

(2012 Admission onwards)

Time : Three Hours | Maximum Weight : 30

Part A

Answer any five *questions.*
Each question has weight 1.

1. Find the integral curves of $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$.

2. Eliminate the constants a and b from $z = x + a x^2 y^2 + b$.

3. Show that $xp = yq$ and $z(xp + yq) = 2xy$ are compatible.

4. Find the complete integral of $p^2 + q^2 = x + y$.

5. Classify the following equations :

   (a) $u_{xx} + x^2 u_{yy} = 0$.

   (b) $y^2 u_{xx} - 2xy u_{xy} + x^2 u_{yy} = 0$.

6. Find the particular integral of $(D^2 - D^2)Z = e^{2x+y}$.

7. Define the family of equipotential surfaces and the corresponding potential function.

8. Explain interior Churchil problem.

$(5 \times 1 = 5)$

Turn over

Part B

Answer any **five** *questions.*
Each question has weight 2.

9. Find the integral curves of the equations $\frac{dx}{x+z} = \frac{dy}{y} = \frac{dz}{z+y^2}$.

10. State the Cauchy's problem for first-order equations.

11. Explain :

    (a) Complete integral ; (b) General integral ; and (c) Singular integral ; (d) Particular integral of non-linear partial differential equations of first order.

12. Solve by Charpit's method : $p^2x + q^2y = z$.

13. Form the second order partial differential equation : $u = f(x+iy) + g(x-iy)$.

14. Find the particular integral of :

    $\left(D^2 - D^1\right)Z = 2y - x^2$.

15. Establish a necessary condition for the existence of the solution of the interior Neumann problem.

16. Discuss both kinds of initial conditions for linear hyperbolic equations.

$(5 \times 2 = 10)$

Part C

Answer any **three** *questions.*
Each question has weight 5.

17. Obtain a necessary and sufficient condition that the Pfaffian differential equation $X \cdot dr = 0$ should be integrable.

18. Find the surface which intersects the surfaces of the system $z(x+y) = c(3z+1)$ orthogonally and which passes through the circle $x^2 + y^2 = 1, z = 1$.

19. Solve by Jacobi's method

    $z^2 = xu_x - u_x^2 - u_y^2 = 0$

20. Find the complete integrals of :

(a) $pq\,z = p^2\left(x_n + p^2\right) + q^2\left(yp + q^2\right)$.

(b) $Z = px - qy - pq$ by Charpit's method.

21. Reduce to canonical form and solve :

$$y^2 u_{xx} - 2xy\, u_{xy} + x^2 u_{yy} - \frac{y^2}{x} u_x + \frac{x^2}{y} u_y.$$

22. Solve by separation of variables

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = \frac{1}{k}\frac{\partial z}{\partial t}.$$

$(3 \times 5 = 15)$