B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER –5: MATHEMATICS (CORE COURSE FOR MATHEMATICS AND COMPUTER APPLICATIONS)

COURSE: 15U5CRMAT6-15U5CRCMT6: DIFFERENTIAL EQUATIONS

(Common for Regular 2017 Admission & Improvement 2016/Supplementary 2016/2015/2014 Admissions)

Time: Three Hours   Max. Marks: 75

PART - A

*Answer **all** questions. Each question carries **1** mark.*

1. Find the value of b for which the equation $(xy^2 + bx^2y)dx + (x + y)x^2dy = 0$ is exact.

2. Solve the differential equation $y' + 2xy = 0$.

3. Find an integrating factor for the differential equation $sin2x\frac{dy}{dx} = y + tanx$

4. Reduce $\frac{dy}{dx} + \frac{x}{1-x^2}y = x\sqrt{y}$ to linear form.

5. Write the general solution of $ay'' + by' + cy = 0$ whose characteristic equation has roots $\lambda \pm i\mu$.

6. Solve $y'' - 4y' + 4y = 0$.

7. Write the Bessel's equation of order p.

8. Find the singular points of the differential equation $2x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + (x - 5)y = 0$.

9. What is the auxiliary equation of Lagrange's linear partial differential equation?

10. Prove that $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ is the solution of partial differential equation $2z = x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$.

(1 x 10 = 10)

PART - B

*Answer **any eight** questions. Each question carries **2** marks.*

11. Prove that $\mu(x, y) = x$ is an integrating factor of the differential equation
$(3xy + y^2) + (x^2 + xy)y' = 0$.

12. Show that the equation $(1 + 4xy + 2y^2)dx + (1 + 4xy + 2x^2)dy = 0$ is exact and solve it.

13. Convert the equation $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 0$ in to ordinary differential equation with constant co efficient.

14. Solve the equation $x\,siny\,dx + (x^2 + 1)cosy\,dy = 0$.

15. Solve the differential equation
$4x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 3y = 0$

16. Prove that $J_1(0) = 0$

17. Locate and classify the singular points of $(x^4 - 2x^3 + x^2)\frac{d^2y}{dx^2} + 2(x-1)\frac{dy}{dx} + x^2y = 0$

18. Solve $\frac{dx}{x^2} = \frac{dy}{y^2} = \frac{dz}{(x+y)z}$

19. Form a partial differential equation by eliminating arbitrary function for
$z = f(x+it) + g(x-it)$.

20. Write a set of parametric equations of a surface $x^2 + y^2 + z^2 = a^2$. $\hspace{2cm}$ (2 x 8 = 16)

PART - C

*Answer **any five** questions. Each question carries **5** marks.*

21. Solve $2xy\frac{dy}{dx} - y^2 + x^2 = 0$

22. Given that $y = x$ is a solution of $(x^2 + 1)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$ then find a linearly

independent solution by reducing the order.

23. Solve the equation $y'' - 2y' - 3y = 2e^x - 10\,sinx$.

24. Solve $\frac{d^2y}{dx^2} + 4y = \cos 2x$

25. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}}\sin x$

26. Find the integral curves of the equation $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2+x^2)} = \frac{dx}{z(x^2+y^2)}$.

27. Find power series solutions in powers of x of the differential equation $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$

$\hspace{10cm}$ (5 x 5 = 25)

PART - D

*Answer **any two** questions. Each question carries **12** marks.*

28. Define an oblique trajectory. Find a family of oblique trajectories that intersect the family
of straight lines $y = cx$ at angle 45^0.

29. Solve $x^3y''' - 4x^2y'' + 8xy' - 8y = 4\,lnx$.

30. Use method of Frobenius to find the general solution of the differential equation
$2x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - 3)y = 0$

31. (i) Form a differential equation corresponding to $(x-a)^2 + (y-b)^2 + z^2 = 1$.

(ii) Find the general solution of the differential equation $(y+zx)p - (x+yz)q = x^2 - y^2$.

$\hspace{10cm}$ (12 x 2 = 24)

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