

FIRST SEMESTER B.C.A. DEGREE EXAMINATION, NOVEMBER 2014

(CUCBCSS—U.G.)

Complementary Course

BCA IC 01—MATHEMATICAL FOUNDATION OF COMPUTER APPLICATIONS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all the ten questions.

1. Define a singular matrix.
2. Write the characteristic equation of $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$.
3. Find $\frac{dy}{dx}$ if $y = \log(\sqrt{x^2+1})$.
4. If $y = x^x$, show that $\frac{dy}{dx} = x^n(1 + \log x)$.
5. Find $\int \left(\frac{x^2+x+1}{x} \right) dx$.
6. Evaluate $\int_0^{\pi/2} \sin x \, dx$.
7. Solve $y' = x^2$.
8. From the differential equation of straightlines having slope m and passing through the origin.
9. Solve $\frac{d^2y}{dx^2} - y = 0$.
10. Solve $\frac{d^2y}{dx^2} = \frac{dy}{dx}$.

(10 × 1 = 10 marks)

Turn over

Section B

Answer all the five questions.

11. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$. Find $A^2 - 5A + 7I$.

12. For the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, find $\frac{dy}{dx}$.

13. Evaluate $\int \frac{1}{x \log x} dx$.

14. Form a differential equation, given $y = cx + c^2$.

15. Solve $\frac{dy}{dx} - \frac{x}{y} = 0$.

(5 × 2 = 10 marks)

Section C

Answer any five questions.

16. Find the rank of $\begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ 2 & 3 & 10 \end{bmatrix}$.

17. If $A = \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}$, find A^{-1} and verify that $AA^{-1} = I$.

18. Differentiate from 1st principles $y = \frac{1}{\sqrt{x}}$.

19. If $\sin y = x \sin(a+y)$, show that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$.

20. Evaluate $\int \log x dx$.

21. Evaluate $\int (2x+1)(x^2+x+1)^{3/2} dx$.

22. Solve $\frac{dy}{dx} + \frac{y}{x} = x^2$.

23. Form a partial differential equation if $z = ax + by + ab$.

(5 × 4 = 20 marks)

Section D

Answer any five questions.

24. Find the eigen values and eigen vectors of :

$$A = \begin{bmatrix} 0 & 0 & -2 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$$

25. Solve by Gaussian elimination method :

$$6x_1 + 2x_2 + 8x_3 = 26$$

$$3x_1 + 5x_2 + 2x_3 = 8$$

$$8x_2 + 2x_3 = -7.$$

26. (a) If $xy = ae^x + be^{-x}$, prove that $x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - xy = 0$.

(b) Show that :

$$f(x) = \begin{cases} 2+x & \text{if } x \geq 0 \\ 2-x & \text{if } x < 0 \end{cases}$$

is not differentiable at $x = 0$.27. (a) Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$.(b) Evaluate $\int \frac{1}{(x+1)(x+2)} dx$.28. (a) If $y = x^{x^x}$, prove that $\frac{dy}{dx} = \frac{y^2}{x(1-y \log x)}$.(b) Evaluate $\int \frac{11x+6}{10x^2+11x+3} dx$.29. (a) Solve $xy \frac{dy}{dx} = 1+x+y+xy$.(b) Solve $\frac{dy}{dx} = e^{x-y}$.

30. (a) Solve $\frac{dy}{dx} = \frac{y + \sqrt{x^2 + y^2}}{x}$.

(b) Solve $4\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 3y = 0$.

31. Solve $\frac{d^2y}{dx^2} - 4y = e^{2x} + \sin 2x$.

(5 × 8 = 40 marks)

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